

127

Sohn

Misc

1967-1979

July 21, 1979  
Yugoslavia

7/21/79-A

Limestone - u. Permian & l. t.  
Nada gave me. Uppermost Permian  
black ls. Quarry, Slovac village.  
coll. Kristic July 1979

7/21/79-1

Permian Step 1 A

skip Step B; Carboniferous  
took sample

7/21/79-2

p. 9 Gray sandy marls  
coll. by STEW.

7/21/79-3

Gas zone below 877, but  
below house - etc.

7/21/79-4

loc: 941 E. side of  
Blumensteingasse

7/21/79-5

Triassic lower  
ls. NW of Statue Marl bet

May 10, 1979

# Stratotype Guidebook

5-10-1

Stop 1 - Spale for pretty  
good view for stratigraphic  
positioning

5-10-1

Stop 2 - Greenbrier

from boulders on road 500'  $\pm$   
downhill from bus stop  
Should be  $\neq$  Chester

5-10-2

Greenbrier, float 250'  $\pm$  up  
hill from bus. Stop 2

Stop 3

bed = dark red, shows by underlying

Hinton - in pt. Miss.

plants show Pennsylvanian age.

Now massive & massive

5-10-3

Sec. 10

Ostr. Shale

20'  $\pm$  below (10) mark

5/10/4

Sec. 52

4'  $\pm$  above (52)



5/10/79 p. 2

Stop 4 (10) (29) (39)

5/10/5 at base of (29)

5/10/6 at (39) 8 feet below

5/10/7 at above (39)

5/10/8 float bet (32) & (39)



5-11-79

Stop 5.

5-11-1 Unit 13

Stop 6

(11)

(12)

5/11/2

(11)

ostr. zone Darwinia

Do not wash

Stop 7 - Coal Mine

Stop 8

5-12-79 P.1

STOP 17

5-12-1 shale, Lingula (28)

5-12-2 shale

5/12/3 same as 5/12/2 small

bag with black gas, Trilob  
slout at above  
Woody has more coll.



5/13/17  
4th day  
Rain & Cold

5/13/1 P. 31 ~~Kenneth~~ Black point  
Winged Ls (114)

5/13/2 above Hanshaw's cor  
of Kendrick  
cloth bag channel  
Plastic bag 0"-3" above  
coral  
In W. Va = Dingo but  
not Kentucky Dingo  
Hanshaw corals & fine  
clay coal, Ky.

~~5/13/3~~ Stop 21 (P. 39)  
Too hard, orbicled no  
sample



Fifth Day

May 14, 1979

Stop 23

5/14/1 Kanawha two mile road  
and Edgemoor Fork Rd at  
Interstate 77 (p. 44)  
Two mile ls. Fresh water,

Stop 26

5/14/2 Unit 5  
2 bags cloth shale  
Plastic over cloth  
spirorbis ls. for crushing

Stop 27 (unit 12)

5/14/3 ls with ostr. + shale or  
weathered - crush ls.

Sixth Day

May 15, 1979

Int. Carb. Cons

Stop. 30

5/15/1

Upper Rockport Ls.  
Hard Ls. - crush  
on side of dirt Rd

5/15/2

shale (calc.) below  
middle Rockport Ls.  
in road cut. green below  
red. (wash.)

Stop. 31

5/15/3

disc. No ostr. <sup>disc</sup> Ames Type section  
shale 1'± above 5/15/4  
clams, small <sup>disc</sup> should have Cavellinia ostracoda,  
worms.

5/15/4

Shale 1 1/2'± above Ls. + 1'±  
below 5/15/3

5/15/5

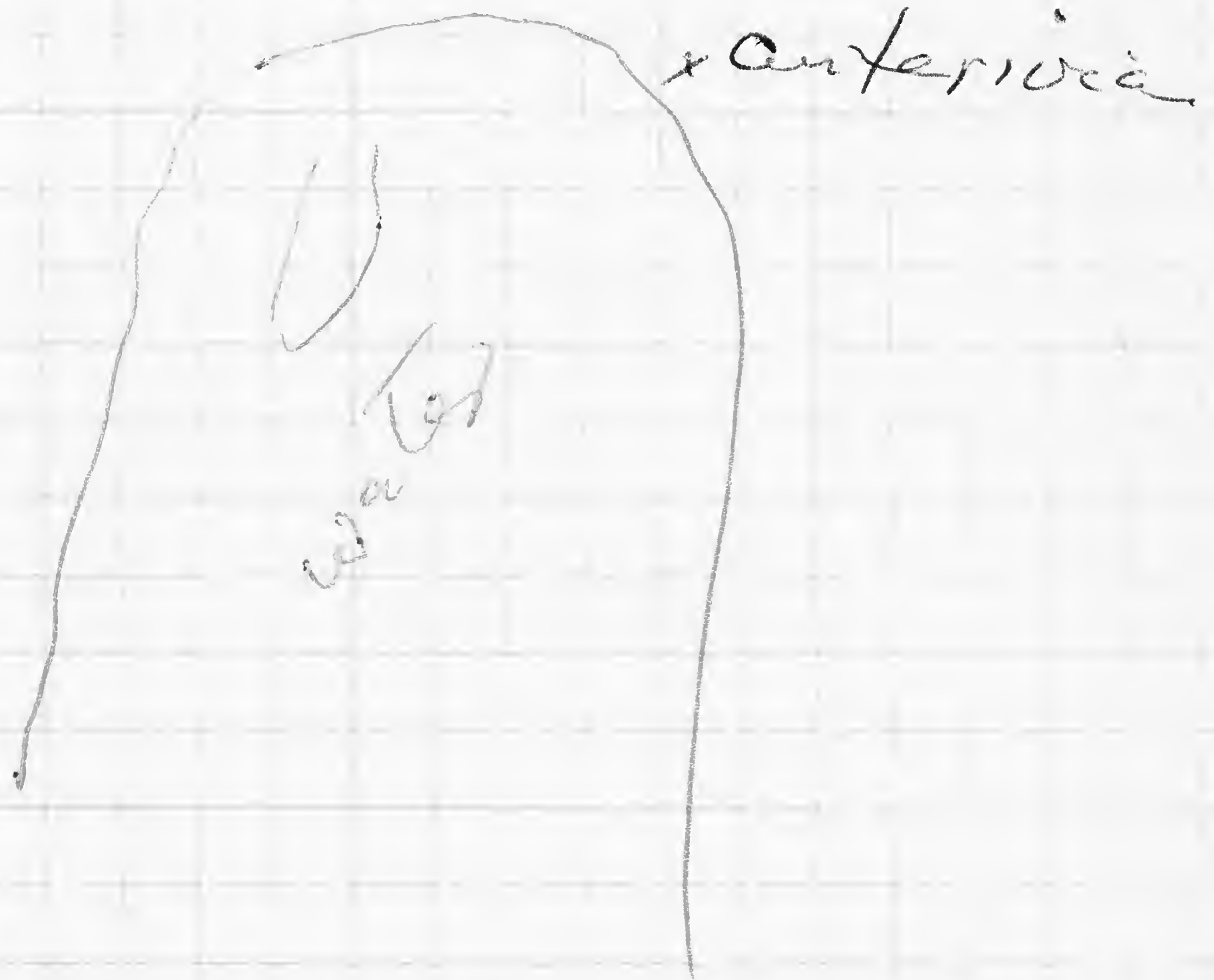
barren  
discards

underlay below Harlan  
coal. Use ssp. as a guide.



8/23/74

Figs - 3, 4 N ←





Visby, Gotland

8/27/74

8/27/-1

Snäckgårdsbaden 1

Highest unit in Upper Visby  
beds.

Visby

8/28/74

8/28-1

Walled City North end  
walked south on Övre  
Finngränd, ls outcrop  
on east side. collection  
of weathered seams  
just above street level  
inside of wood rail.  
The corner of that street  
has a fish store on  
Ryska Gränd.  
Höglint Beds (middle of beds)

Visby

8/29/74



Oct. 18

Bus to airport	\$ 0.50
Coffee	67¢
Taxi airport to Gads	2.00
Dinner	1.45
Lodging (Dinner)	\$ 18.72
	1.50

19

Breakfast  
Coke

1.55  
15

Lunch  
Groggins  
Coke  
Hail

2.15  
3.26  
.21  
5.16

Dinner

4.00

Groggins

1.85

Phone

.10

Phone

.20

20

Paper

1.00

Coke

2.00

Dinner

2.50

21

Paper

.10

Breakfast

1.85

Dinner

3.00

22

Breakfast

1.85

Dinner

3.00

23

Breakfast

2.02

Lunch

1.35

24

Motel

21.50

Breakfast

3.00

Lunch

4.60

Dinner

40.85

25

Breakfast

2.50

Taxi to airport

4.00

Dinner

3.75

Hour

Oct 26	Breakfast	2.00
	Grocery	2.12
	Dinner	4.61
	Motel	8.48

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Oct 27	Breakfast	1.71
	coke	.15
	Dinner	6.29

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Oct 28	Breakfast	1.51
	coke	.15
	Dinner	4.29
	Motel 2 nights	—

Oct. 20, 1973

P 1

Frenchman Cr. C. Longwell  
Las Vegas, Nev.

10-20-1-73  
No Ostr.

Top of Rainbow Garden Fm.  
Ls & mudstone SE of Rainbow  
Gardens. Below gypsum cut.

~~S 9 T 21 S R 63 E~~ <sup>S 17 T 21 S R 63 E</sup> Frenchman Cr. NW 1/4

10/20-2-73  
No Ostr.

NE of Gap by fault in  
basal Cgl. of Rainbow Gardens  
Fm. Red sandy ls. above top  
of Cgl. below rd in valley  
~~S 4 T 21 S R 63 E~~

10-20-3  
No Ostr.

Red soft limestone above  
road about 60' above

10-20-2  
~~S 4 T 21 S R 63 E~~

10-20-4  
? No Ostr.  
Dissect

White ls. blocks from top  
of cliff rolled down  
500' ± above 10/20/3

10-20-5

Trius Chukle Fm  
below fault on rd; overlain  
by Cgl of Rainbow Gardens  
S 9 T 21 S R 63 E

10-20-6  
No Ostr.

Rainbow Garden Fm. within  
25' of Top below Cgl. ± 20'  
thick above gypsum cut.  
Hwy 16 NW 1/4 sec 16  
R T 21 S R 63 E



Oct. 21, 1973 p.2  
Frenchman Mt. with Chester Lange

Drove up rd to side road  
to peak. Stopped at first  
gate which was locked  
SE  $\frac{1}{4}$  Sec. 24 T 20 S R 63 E

10-21-1  
No Obs.  
disc. Two to 3 feet in calc. zone in Neo Miss. on top of

10-21-2  
Massive ledge forming  
ls. about  $\frac{1}{2}$  up slope  
stratigraphically about 20' above  
10-21-1

10-21-3  
Devonian (Penn)  
NE  $\frac{1}{4}$  Sec 24 T. 20 S. 10/21/4 Torowcap  
R 63 E 10/21/3 Dev.  
just S of rd.

10-21-4  
Penn. Torowcap above  
fault

10-21-5  
No Obs. Lake Mead Blvd, rd S of  
Rainbow Gardens Fm somewhere  
in the middle.  
Strike N 21 E, Dip 60° SE

Frenchman Mesa 10-22-73<sup>1.3</sup>  
C. Longwell

Lake Mead Blvd.

10-22-1 Ls. in Thumb fm, between  
No ostr breccia, Basal Thumb  
discovered R 63 E intersects road

10-22-2 Valley of Fire  
No ostr Aztec ss (Jurassic)  
discovered on road to Overton  
Visited Lost City Museum

~~10-22~~



Oct. 25, 1973 p. 4  
W. H. F. W.

10-25-1-73 Plant bearing shale  
WIF-72-1 of OER-72-2  
about 40' below base  
of Middle Sandstone Member  
of Chalk

10-25-2-73 Sandy mud within Middle  
Sandstone Member of Chalk.  
110' along rd. E of 10-25-2

10-25-3-73 Gray shale below cgl.  
3/4 mile S of Romeville  
intersection 70' East along R  
from WIF 72-2



SANTA ROSA SANDSTONE

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Upper Ss mbr

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Shale mbr

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Middle Ss mbr

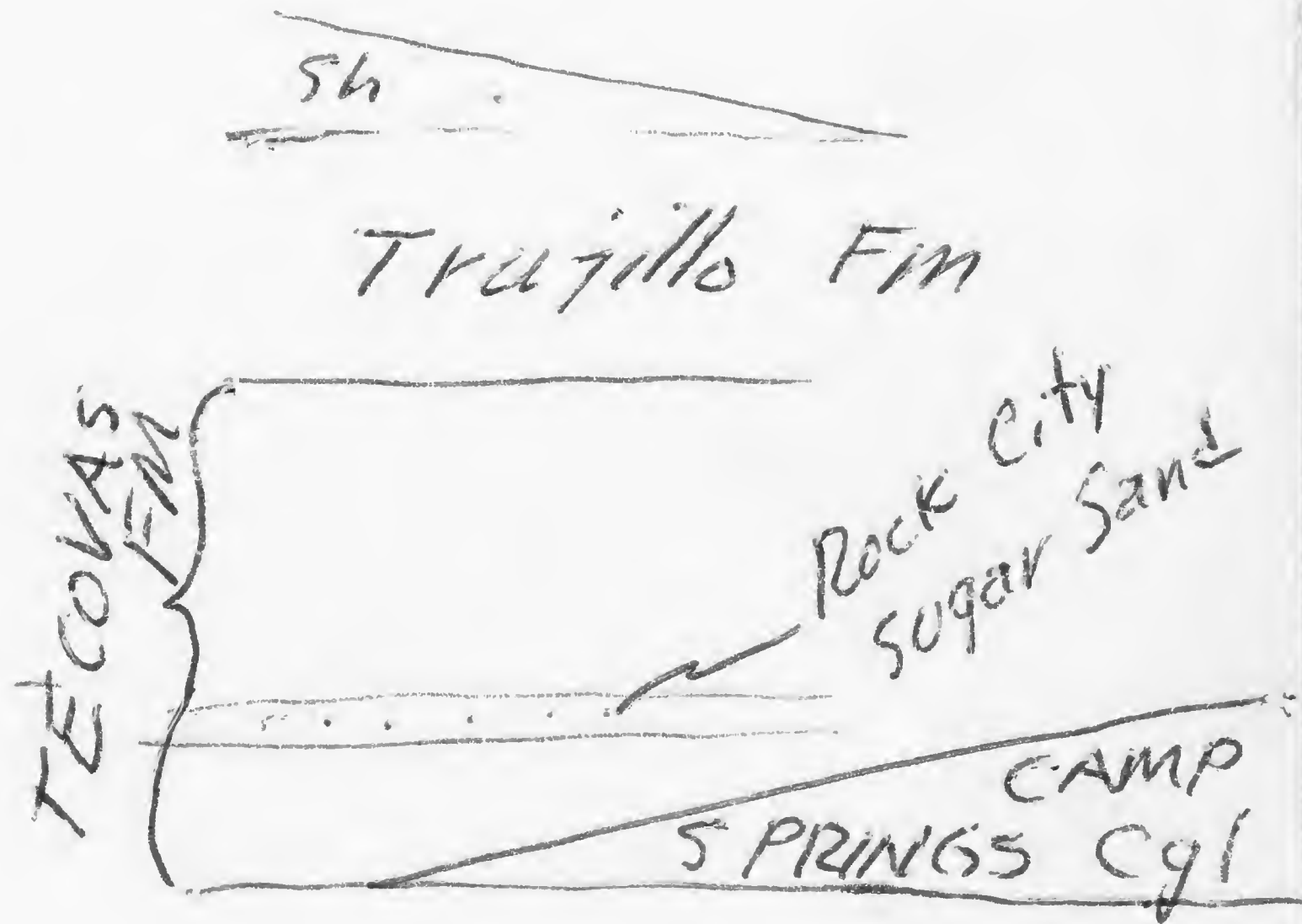
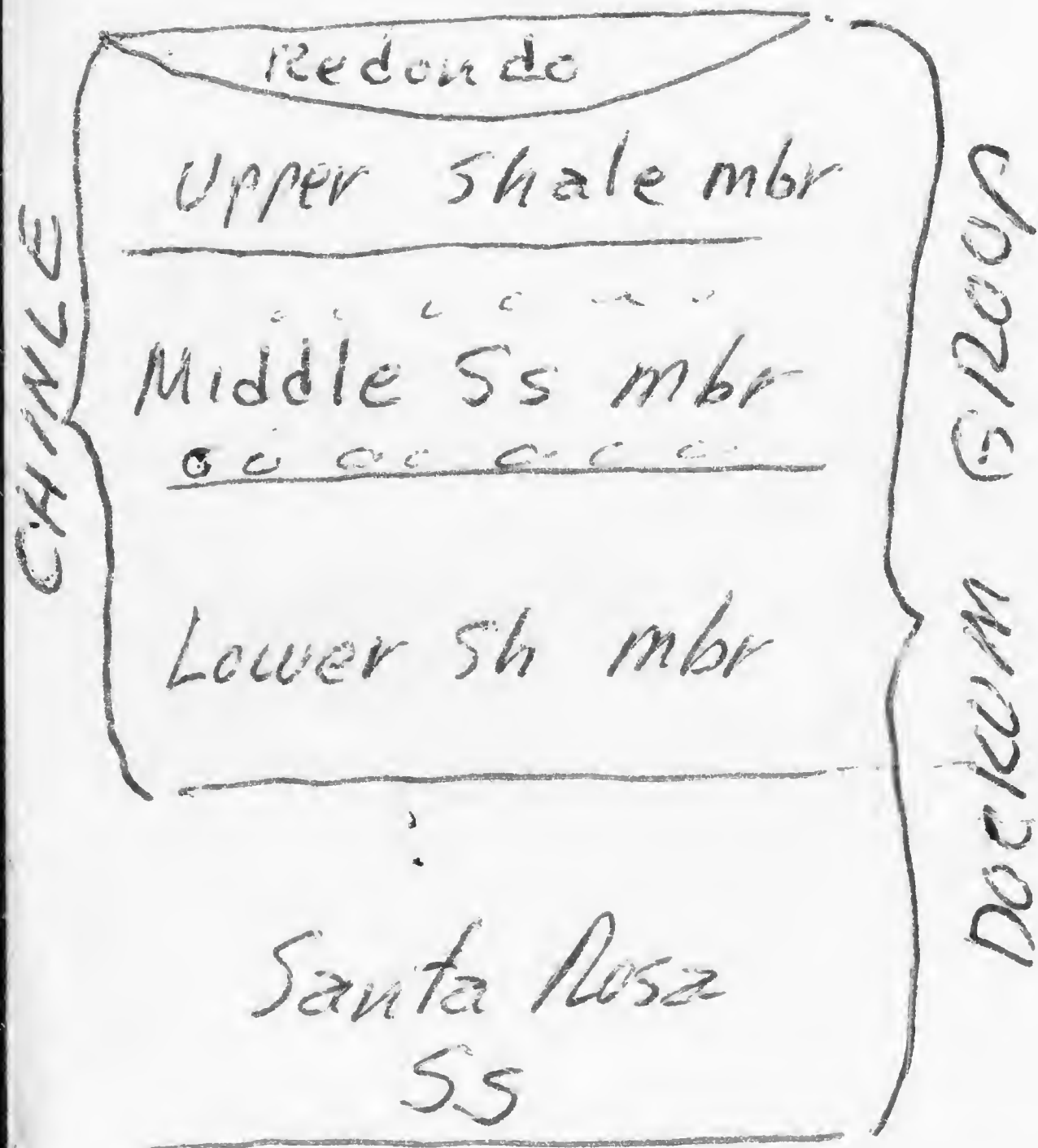


Lower Ss mbr

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N MEX

TEX





Oct. 26, 1973 p. 5  
Santa Rosa

RR cut at Santa Rosa  
Shale, North side of cut  
Unit 6 Type sect. 5'-10'  
above base of middle ss member  
within cgl bed

10/26/1/73  
No Ostr.  
Discarded

10/26/2/73  
No Ostr.  
Discarded  
Shale<sup>ls.</sup>, upper part, middle ss  
Member, North side of  
same cut and above,  
200' W along RR tracks.  
+ some top of M. ss and underlying  
shale member. Surface weathered  
material at base.

10/26/3/73  
No Ostr.  
Discarded  
Shale across tracks from  
10/26/2, where it is  
thicker, sample strat.  
below 10/26/2, 1 1/2' ± channel  
sample in softer shale

10/26/4  
No Ostr.  
Discarded  
E end of RR cut;  
1' shale approx 4' above  
base of shale member  
Santa Rosa Fm. Channel 1' ±

Buffalo Creek

Oct 26, 1973  
p 6

10/26/573

Same locality as pictures  
of *Dasyatis*, saw one spec.  
in rocks. Same as  
WIF 70-4, 600' from rd. 212  
2nd outcrop of shale.

10/26/6

Daykey shale E of  
10/26/5 300' to 350'  
from Rd. First outcrop  
of green shale in Buffalo  
Creek W of 212.

Both samples in Chinle,  
near base.

New Mexico Bull. 98, 1972  
L<sup>1</sup>/<sub>2</sub> of Fort Sumner Sheet  
by Vincent C. Kelley  
see fault on map across  
Buffalo Creek



Oct 27, 1973  
p. 7

10/27/1/73 Road cut Hwy 104 - San Miguel Co., New Mexico S. 4, T 12 N R 25 E, Mudstone in upper part of Middle Sandstone Member of Chinle South of Cuelbo Cr.; Topmost of 3 shales

10/27/2/73 Calcareous pellet conglomerate with carbonaceous matter  $2\frac{1}{2} \pm$  above 10/27/1

Kelly Bull, 98  
Cuelbo ss. member of Chinle

10/27/3/73 Revuelto Creek Marshall Sec. Uno bed, Sec. 21, T 11 N, R 33 E, Quay Co. N.M. San Jon NW  $7\frac{1}{2}$  min. Same as WIF Middle Sandstone Member Chinle at base of uppermost sand ledge in unit.

Oct 27, 1973  
p. 8

- 10/27/4 Palo Duro Canyon State  
Park  
Trail Measured section  
Mesquite Park  
Bentonitic brown clay  
approx 10' above base  
of Tecovas Fm. Dickinson Group  
Unit 11 of Wright's Sec
- 10/27/5 Permian Quartermaster (?)  
Red & Green claystone siltstone  
unit 2 of section  
approx 65' below 10/27/4  

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Goodnight Peak Highway section
- 10/27/6 Rd. out of Canyon  
Mudstone Unit 17?  
Trijillo fm 25' ± uphill  
from slide area sign  
below lookout with sign
- 10/27/7 Chino unit 20 about  
the middle (27' thick unit)



Fig. 1



Texas

Oct. 28, 1973  
with WIF.  
p. 9

10/28/1

Roadside sample of clay/bentonite  
near Top of Tecovas Fm.  
Cap Rock SE  $\square$ , Garza Co, Tex.  
10,000' E of Texas State Rd 207  
(see Fig. 1 for Topo loc) 15'  $\pm$  below  
Top of Tecovas Fm. (Trias.)

10/28/2

On State Rd 207, west side  
clay 1'  $\pm$  below 1'  $\pm$  ss and  
above thin ss. Within the  
Trojillo Fm. South, Dokegood  
Creek  $\square$ , South slope of  
North Fork of Double Mountain Fork  
of Brazos River, 13000' North  
of Rd intersection at 2596' elevation.  
Same horizon as Hillside Uranium  
Mine.

10/28/3

Clay in Trojillo Fm.

Buenos Oil Field Garza Co. Tex.  
in Dokegood Cr. in same  $\square$  10/28/2  
8'  $\pm$  above creek level, 10' below (strat)

10/28/4

10/28/4

Clay in second (C) sand in  
Trojillo Fm. above 10/28/3 (10'  $\pm$ )  
same as WIF 70-13, taken along  
rd.

Oct. 28, 1973  
W I Finch

p. 10

10/28/5

Bunker Hill □ SE  $\frac{1}{4}$   
Dickens Co.  
Negro Hill E side of  
rd. down slope at curve.  
Tecovas Fm., Upper pt.  
1st. green seam in Motorcycle  
path within red, bentonitic  
clay.

10/28/6

Collett Springs Texas  
Negro Hill, last spur  
above 3710, NW side  
of creek.  
Clay in the Tecovas Fm  
below unit #1 of Wright  
Green bentonitic

10/28/7

same □ as above  
Green bentonitic clay  
above red bent. clay  
unit 16 of above section  
approx 6,000 feet map distance  
West.  
Trojillo fm., below base  
of second s.s. ledge along  
road.



Oct. 29, 1973  
with W.M. Quackenbush  
+ WIF p. 11

10-29-1

Boden ~~in~~ Potter Co., Tex.

Lower part of Teecopa Fm.  
in stream bed just  
below yellow band, 1' of  
clay below sand = WIF 73-4

10-29-2

4" bed upstream  
between yellow silt  
approx same strat level

Morgantown, W. Va. Sept 25, 1972

Falke { Plumbell 166 or 67 Oelkale  
Ostracodes  
Antennaria (L. Perm.) 280 may

M. pt Antennaria 265 may

L/u. Rotliegendes 240 may

Wille  
Brownville - Top. Perm.

one or 2 feet maybe Perm.

Tlys - 056. Perm. Continental France

Burke - Cleveland Museum

(T. Geis Coet. from Colorado or Utah  
also from cross. 1970 ±)

Lund

Nineveh LS & Windy Gap = Permian Perm

Fish Pot. } Stephensian  
Pittsburg }



Sept 26, 1972  
Clearing



I. C. White Memorial Symposium  
Field Trip - Thomas Arkle Jr. Leader  
Sept. 27-29, 1972 9/27/72, p. 1

9/27/1/72 Upper Ames coll. in road cut  
West Virginia Route 7, on north side  
of Decker Creek, approximately  
110 feet N-NW along Route seven  
from south end of Morgantown  
North Quadrangle, East of  
Morgantown, W. Va. Ames  
Limestone above coal, coll.  
from claystone with Chonetes  
that fell from cliff.  
Stop. 11 of Guidebook, p. 9

9/27/2/72 Stop. 7A of Guidebook, p. 19.  
Wadestown Quadrangle, W. Va - Penn.  
Monongalia Co., North side of  
West Virginia Fork of Dunkard Cr.,  
at village of Wana. Weathered  
shale directly under Jollytown Coal  
about 1 foot channel.

9/27/3/72 Stop 8 of Guidebook, p. 19  
Monongalia Co., Hundred Quad.,  
W. Va - Penn., northeast side of  
W. Va. Route 7, where county line  
crosses road. coll. of limestone  
in Gilmore ls. (clustering paper in current  
used this ls. as one of the samples)

9/27/4/72 Shale and limestone below 9/27/3

I C White Symposium  
Field Trip p. 2

9/27/5/72 Below 9/27/4/72 coll. Yockelson.

9/27/6/72 Stop 15 of Guidebook p. 23.  
Wallace Quadrangle, W. Va., center  
SW  $\frac{1}{4}$  of Quad., on N side of  
Fernside Creek, cut in  
Highway 20, about 40 feet  
west of Pumping Station on  
map. Clay shale 4' below  
nodular zone which represents  
the Lower Washington Limestone  
(First ls. above Main Washington  
Coal).

9/27/7/72 Stop 21, Guidebook p. 26.  
Smithburg Quad., W. Va., North  
side of Buckeye Creek, 1.3 miles  
on map east of "S" in Smithburg.  
Upper part of Bernwood Limestone

9/27/8/72 Small log coll. by Yockelson  
6'  $\pm$  above 9/27/7



I.C. White Symposium  
+ Field Trip

9/28/72  
p. 1

9/28/1/72

Stop. 33, Guidebook p. 39  
New Martinsville Quad., W.Va.-Ohio  
West side Ohio Riv., Rd. south  
of Opossum Creek, 0.9 mile from  
Route 7, and 0.8 mile from  
Valley Church. Limestone  
high in Greene.

9/28/2/72

Shale 1'± above 9/28/1  
(See p 41 of Guidebook)

9/28/3/72

Prob. Wheeling Quad., W.Va. Ohio.  
unscheduled stop at Beerbowers  
loc. Nineveh ls., about 3/3'  
above Washington coal. Thin  
limestone above black shale.  
coll. contains both limestone  
and shale.

Dinner and night in Wilson  
Lodge in Oglebay Park.

I.C. White Symp. & Field Trip

7/29/72 p. 1

- 9/29/1/72 Stop 38, Guidebook p. 53  
Wheeling Quad, W. Va. - Ohio  
cut in U.S. 70, south side of  
Elm Grove  
Limestone in lower part of  
Elm Grove Ls.
- 9/29/2/72 Same loc. as 9/29/1/72  
First limestone below  
Waynesburg Coal (see Fig. 17 of  
Guidebook)
- 9/29/3/72 Top of Elm Grove Ls., above  
9/29/2/72
- 9/29/4/72 Stop 39, Guidebook p. 54  
Valley Grove Quad, W. Va. - Penn.  
Exit 11 at Dallas Park Exit  
entrance to Interstate 70.  
High Ls. in Greene.
- 9/29/5/72 Same stop as 9/29/4  
coll. above 9/29/4.  
End of Trip



9/29/72 p. 2

Yackelson drove me to  
Greer Quarry where Dunkle &  
students had a vertebrate dig.  
From Lakaview Inn cross bridge  
on Route 73, 0.6 mile turn  
left on Pioneer Rocks 5.4 miles  
left on Route 7 to Greer; or  
from Morgantown take Route  
7 (92) that goes to Masontown,  
between 4 miles and 5 miles  
to Greer. The office is on  
south side of Duckers Creek, get  
permission from foreman  
(1972, Mr. Bill Filchner), but  
outcrop is above mine on  
north side of creek, Morgan Co.,  
Masontown W. Va. Quad.

9/29/7  
12894-PC

Reynolds Member of Bluefield shale  
face of cliff above Dunkle's  
dig. Calcareous shale, dark with  
some red.

9/29/8  
12895-PC

Darker, more limy, 18" below 9/27/7

9/29/9  
12896-PC

4 1/2 feet below 9/29/8

9/29/10  
12897-PC

Weathered surface of ls. block that fell  
from 10' ± above 9/29/7

9/29/11  
12898-PC

Greenbrier ls. from mine at Greer.  
below coll. 9/29/9



9/27/TZ

9/27/1 Stop 1 - clay stone with  
Upper Ames  
coll. from road level of sp. 100  
cliff above road.

9/27/2 Stop 7 A weatherside  
shale directly under  
Jellystone coal (cladding)  
Says Boyd Coal? ST. 100  
loc. by Newbold Limited  
coll. 7 1' + width  
Barlow said one of his J. 100  
9/27/3 Stop 6 ls. 100 by  
cladding

9/27/4 ~~shale~~ + ls. below 9/27/3

9/27/5 Yockelson below 9/27/4  
also ls. coll. by Smith (D)

9/27/6 Stop 15. clay shale  
4' below under last road  
represented lower  
above = Lower Washington  
ls. Cist ls. above  
Main Washington Coal

9/27/7 stop 21 upper Benwood  
small bag 6' + above  
coll. Yockelson

9/27/8  
Dinner 4:20



break at 7/28

9/28/1 Stop 33 WCA 15 9/28/2  
Ellis has on section  
at 31.4  
at 32.2 at 32.3 at 32.4 at 32.5 at 32.6 at 32.7  
9/28/2 Shale 15 above 9/28/1

9/28/3 Nine inch ls. 313+ above  
W. G. Coal. Loc. B. 1000 ft.  
Thin ls. above black shale  
coll. contains both ls. & sh.  
Dinner 36

9/29/4 Stop 39 High Green ls  
coll. 1000 ft.

9/29/5 above 9/29/4.



9/29/72

Breakfast 8:50

6 Collections

Last coll 9/29/6 is  
a piece of 8ft. Ls.

in quarry make section

Green Quarry

9/29/7



May  
Atomic Plant May 22, 1968

5/22/1 - Zone 19 - shell bed just  
S. of Fence - blue-gray weathered  
brown - bivalved pebbles

5/22/2 Zone 18? on shore about  
5' below (strait) coll. 5/22/1

5/20/3 Zone 20 face of 5th  
step <sup>against the wall</sup> 5' ± above undulated  
position of zone 19

5/20/4 3rd step undulated  
cap on floor of step  
just above or part of zone 20

5/20/5 3rd step against the wall  
blue clay just below iron seam

5/20/6 Ten fossiliferous sand above  
iron seam 3" - 4" thick seam

5/20/7 Zone 17,  $\frac{1}{2}$  mile  
N of BGE site falling  
of Whale Skull. coll. by  
L. W. Ward May, 1968.

5/20/8 Zone 17, Greensand facies  
at discharge channel coll. L. W. Ward



with Sumner. Sept 12, 1967

Eagles in sh. under a s.s.  
mound, ostracods + a few  
Myalocypids on floor of top of cut  
near Knaprock pits, 1-3!  
The Myal. are large, partly preserved

9/12/1 - coll. near Knaprock. Gyp. x/15. 1 lb  
radiata, small only + rare Myal.  
12" interval = 12903-PC

check shale for Boston to see if  
Murch. or more common.

Pit. Churchill. 11/11, Knaprock  
also 9/12/2 + 9/12/3 on floor

9/12/2 about 4' strat below 9/12/3  
Roughly same level

9/12/3 about 8' below sand = 12889-PC

9/12/4 about 9' below sand =  
12904-PC

see 7/26/67 p. 1, 2 for  
loc. of Balkan, Ky. ☐ map



sand

↓ 2' below

9/12/1 →

4'

9/12/3 →

1' ±

8' below sand

9/12/4

9' below sand

9/12/2 about 4' below 9/12/3

... productids and ...  
Eastwood, T. and others 1931, p. 87.  
Geol. Surv. N.S. 28 ; Ord. New Pop. 82.

Distington, 4 miles N.E. of Whitehaven. Barfs Quarry (disused), 200 yds. N.W. of village.

Carboniferous Limestone Series (First Limestone, c. 50 ft.), with corals (*Dinophyllum*, *Lonsdaleia*) and *Gigantoproductus*.

Eastwood, T. and others 1931, p. 94.

Geol. Surv. N.S. 28 ; Ord. New Pop. 82.

Distington. Barfs Silica Works, long quarry midway between Distington and High Harrington railway stations, at junction of three roads 1 mile N.W. of Distington Church.

Carboniferous, Hensingham Group, with the brachiopod *Schizophoria resupinata* abundant.

Eastwood, T. and others 1931, pp. 104-105.

Geol. Surv. N.S. 28 ; Ord. New Pop. 82.

Frizington, 5 miles N.E. of Egremont. Frizington Parks Quarry (disused), N.E. of Scalelands Farm, 1 mile S.S.E. of Frizington Church.

Carboniferous Limestone Series, limestones and thin shales near top of Seventh Limestone. The corals *Syringopora* near the top and *Nematophyllum minus* lower down ; small productids near the base ; gastropods in dark limestone.

Eastwood, T. and others 1931, p. 87.

Geol. Surv. N.S. 28 ; Ord. New Pop. 82.

Frizington. Yeathouse Quarries, E. of Yeathouse railway station,  $\frac{1}{2}$  mile E. of Frizington.

Carboniferous Limestone Series, from base of series to top of Fourth Limestone in a series of quarries and cuttings. Ostracods occur in basal beds in railway cutting ; the coral *Syringopora* at top of Seventh Limestone ; giganteid brachiopods in Sixth Limestone ; algal (*Girvanella*) and brachiopod (*Davidsonina* [*Cyrtina*] *septosa*) bands in Fourth Limestone, with the coral *Orionastraea*.

Eastwood, T. and others 1931, p. 88.

Geol. Surv. N.S. 28 ; Ord. New Pop. 82.

Frizington. Eskett Quarry, E. of Winder hamlet.

Carboniferous Limestone Series (from base of Fourth Limestone to top of *juncum*-beds. The sponge *Erythrospongia lithodes* occurs in a band between *Succanmina*- and *juncum*-bed.) Corals (type-locality of *Orionastraea edmondsi* and *Nemistium edmondsi*) and brachiopods.

Eastwood, T. and others 1931, pp. 88-89.

Geol. Surv. N.S. 28 ; Ord. New Pop. 82.

Hensingham, 1 $\frac{1}{2}$  miles S.E. of Whitehaven. Quarries E. of the town and near Overend Farm.

Carboniferous Limestone Series, First, Second and Fourth Limestones with corals (*Lonsdaleia*) and giganteid brachiopods.

Eastwood, T. and others 1931, p. 93.

Geol. Surv. N.S. 28 ; Ord. New Pop. 82.

Hensingham. Stream section, Snebro Gill, continuation of Bedlam Gill on W. side of Main Street.

Carboniferous, thin limestones and shales of Hensingham Group, with sponge-remains, zaphrentid corals, productid brachiopods, lamellibranchs, gastropods (*Bellerophon*), nautiloids and trilobites.

Eastwood, T. and others 1931, p. 100.

Geol. Surv. N.S. 28 ; Ord. New Pop. 82.

Hensingham. Chapel House Gill, 50 yds. N. of Chapel House Farm,  $\frac{1}{2}$  mile S. of Hensingham Church.



Cliff-section 100 yds. N. of Barrowmouth Wood, between Whitehaven and St. Bees Head.

Carboniferous Limestone Series (from base of Fourth to top of First Limestone) with abundant corals and brachiopods.

Eastwood, T. and others 1931, p. 90.

Geol. Surv. N.S. 28 ; Ord. New Pop. 82.

St. Bees. Cliff-section 100 yds. N. of Barrowmouth Wood, between Whitehaven and St. Bees Head.

Permian, Magnesian Limestone with lamellibranchs.

Geol. Surv. N.S. 28 ; Ord. New Pop. 82.

Wilton, near Egremont. Disused quarry 2 miles E. of Egremont.

Carboniferous Limestone Series (Seventh Limestone, about 120 ft. of reddish-grey limestone with thin shales and cherts) with corals (*Syringopora*-band and *Caninia*) and brachiopods (*Linoproductus*) ; fish remains near the top.

Eastwood, T. and others 1931, pp. 92-93.

Geol. Surv. N.S. 28 ; Ord. New Pop. 82.

Woodend, Bigrigg. Clints Quarries, W. of Egremont-Cleator road, S. of Woodend station.

Carboniferous Limestone Series (Third and Fourth Limestones, 260 ft., with thin shales) with corals, brachiopods, algae (*Girvanella*-band about 80 ft. from base) and foraminifera (abundant *Saccamminopsis* near top).

Eastwood, T. and others 1931, p. 80.

Geol. Surv. N.S. 28 ; Ord. New Pop. 82.

Woodend. Disused mineral railway cutting 50 yds. W. of Woodend Mill.

Carboniferous Limestone Series (Fifth Limestone, 40 ft.), with corals (*Lonsdaleia*) and brachiopods (*Chonetes* in white limestone in upper beds).

Eastwood, T. and others 1931, p. 80.

Geol. Surv. N.S. 28 ; Ord. New Pop. 82.

## DERBYSHIRE

Bamford. Stream-section, Swint Clough, W. of Alport Castles Farm, Alportdale. (Alportdale joins Ashop Dale 9 miles E. of Glossop on Sheffield road). Localities 20-24 of Hudson and Cotton, 1943.

Carboniferous, Millstone Grit (Edale Shales and Mam Tor Sandstone, R<sub>1</sub> subzone) with abundant goniatites, crushed in shales, uncrushed in bullions.

Bisat, W. S. and Hudson, R. G. S. 1943, p. 389. Hudson and Cotton, G. 1943, p. 148, with topog. map.

Geol. Surv. O.S. 81 N.E. ; Ord. New Pop. 111.

Bradbourne, 5 miles N.E. of Ashbourne. Disused quarry S.E. of Haven Hill,  $\frac{1}{4}$  mile S.W. of Bank Top Farm, S. of Bradbourne.

Carboniferous Limestone Series (S<sub>2</sub>D<sub>1</sub> subzones) with zaphrentid corals fairly common.

Sibly, T. F. 1908, p. 61.

Geol. Surv. O.S. 72 N.E. ; Ord. New Pop. 111.

Bradwell. Morton's Quarry, W. side of Bradwell Dale.

Carboniferous Limestone Series (D<sub>2</sub> and B<sub>2</sub> subzones) with corals (*Orionastraea placenta*) and brachiopods in bedded limestone, and brachiopods in overlying knoll-reef limestone.

Shirley, J. and Horsfield, E. L. 1940, p. 288, with geol. map.

Geol. Surv. O.S. 81 N.E. ; Ord. New Pop. 111.

accessible), with fish, and a basal pebble-bed with the horny brachiopod *Lingula*.

Trechmann, C. T. 1945, p. 339.

Geol. Surv. O.S. 103 S.W. ; Ord. New Pop. 85.

**Sunderland.** Exposures at N. and S. ends of Tunstall Hill, an elongated knoll 2 miles S. of Sunderland.

Permian, Magnesian Limestone, with brachiopods (*Productus*, *Camarophoria*) and molluscs (*Bakevellia*, *Turbo*) less plentiful now than formerly.

Trechmann, C. T. 1945, p. 344.

Geol. Surv. O.S. 105 S.E. ; Ord. New Pop. 78.

**Sunderland.** Humbleton Hill, 2 miles S.W. of Sunderland. A classic locality now in bad condition.

Permian, Magnesian Limestone. Brachiopods in quarry and exposures up eastern flank of hill ; *Nautilus* in cuttings at top of hill, facing W.

King, W. 1850. Trechmann, C. T. 1945, p. 341.

Geol. Surv. O.S. 105 S.E. ; Ord. New Pop. 78.

**Sunderland**, see also Castletown, Ford Estate.

## ESSEX

**Ballington, Sudbury.** Large chalkpit  $\frac{3}{4}$  mile S.W. of St. Peter's Church, Sudbury, and about 100 yds. E. of Ballington Hall.

Cretaceous, Upper Chalk (*Uintacrinus* zone) with plates of the crinoid *Uintacrinus*, belemnites (*Actinocamax verus*), etc. : capped by Tertiary Beds and Pleistocene glacial deposits.

Boswell, P. G. H. 1929, pp. 16-17.

Geol. Surv. N.S. 206 ; Ord. New Pop. 148.

**Beaumont**,  $5\frac{1}{2}$  miles W.N.W. of Walton-on-the-Naze. Section (now obscured) along edge of pond in farmyard near Beaumont Church.

Pliocene, Red Crag (? Newbournian), with 90 species of molluscs.

Reid, C. 1890, pp. 80, 85.

Geol. Surv. O.S. 48 S.E. ; Ord. New Pop. 150.

**Great Chesterford**,  $3\frac{1}{2}$  miles N.W. of Saffron Walden. Pit by roadside,  $\frac{1}{2}$  mile E. of Great Chesterford Church.

Cretaceous, Middle Chalk (*Terebratulina* zone), with the sea-urchins *Echinocorys scutata* (an interesting shape-variation) and *Micraster corbovis* and other fossils.

Brighton, A. G. 1928, p. 369.

Geol. Surv. N.S. 205 ; Ord. New Pop. 148.

**Harwich.** Cliff-top.

Pliocene, Red Crag (now entirely disappeared), resting on Eocene, London Clay. Section described by Dale in 1704.

Reid, C. 1890, pp. 71, 85.

Geol. Surv. O.S. 48 N.E. ; Ord. New Pop. 150.

**Walton-on-the-Naze.** Coast and cliff-section, accessible along foreshore or from bus-route to the Naze. Marked by Tower on cliff about  $1\frac{1}{2}$  miles N.E. of Walton station.

Pliocene, Red Crag (Waltonian) and basal Nodule Bed (exposed after cliff-falls), resting on Eocene, London Clay. *Neptunea contraria* and other gastropods very numerous, entire but waterworn. Lamellibranchs (including *Glycymeris glycymeris* in prominent bands) common. Derived fossils, sharks' teeth, worn bones, etc. in Nodule Bed.

Reid, C. 1890. Harmer, F. W. 1913-1922.

Geol. Surv. O.S. 48 S.E. ; Ord. New Pop. 150.



**Howick.** Shore-section from opposite Sea Houses Farm S. to 300 yds. S. of Howick Burn.

Carboniferous, Upper Limestone Group. Lickar Limestone in cliff-foot N.W. of Sea Houses Farm with many small brachiopods, gastropods, etc.; Iron Scars and Sugar Sands Limestones S.E. of burn mouth.

Carruthers, R. G. and others 1930, pp. 56-57.

Geol. Surv. N.S. 6; Ord. New Pop. 71.

**Lewie Halt**, 2½ miles S.E. of Kielder. Lewie Burn, 450-700 yds. S. by E. of The Forks, 1¾ miles S.S.W. of Lewie Halt.

Carboniferous, Scremerston Coal Group, with brachiopods (*Productus*, *Punctospirifer*, etc.), bryozoa, mollusca and ostracods.

Geol. Surv. O.S. 108 S.W.; Ord. New Pop. 76.

**Long Houghton**, 5½ miles E.N.E. of Alnwick. Quarry 1¾ miles N.N.W. of Long Houghton Church and ⅛ mile S.W. of Little Mill station.

Carboniferous, Middle Limestone Group, Acre Limestone, with foraminifera (*Saccaminopsis*), zaphrentid corals, brachiopods, etc.

Smith S. 1910, pp. 615-617. Carruthers, R. G. and others 1930, p. 54.

Geol. Surv. N.S. 6; Ord. New Pop. 71.

**Netherwitton**, 6½ miles N.N.W. of Morpeth. Greenleighton Quarry, 4¼ miles W.N.W. of Netherwitton and 1¼ miles N.W. of Longwitton station.

Carboniferous, Upper Limestone Group, Great Limestone, with abundant corals and brachiopods, especially in shales above limestone.

Smith, S. 1910, pp. 621-624. Fowler, A. 1936, p. 37.

Geol. Surv. N.S. 9; Ord. New Pop. 78.

**Rochester**, 5 miles N.W. of Otterburn. Coomsden Burn, 1 mile S.S.W. of White Lee Farm, 8¼ miles N.W. of Rochester, on S.W. side of Jedburgh road.

Carboniferous, limestone near top of Cementstone Group, with algae (*Ortonella*, *Garwoodia* [*Mitcheldeania*]), cephalopods (*Orthoceras*), fish-fragments, etc.

Garwood, E. J. 1931, pp. 135-136.

Geol. Surv. O.S. 108 S.E.; Ord. Pop. 86 (Scotland).

**Rothbury.** Section in Forest Burn, 3⅝ miles S. by W. of Rothbury bridge, ½ mile above Morrelhirst Farm.

Carboniferous, Middle Limestone Group, Oxford Limestone, with algae (*Girvanella*), brachiopods and dibunophyllid corals.

Fowler, A. 1936, p. 27.

Geol. Surv. N.S. 9; Ord. New Pop. 71.

**Rothbury.** Glebe Quarry, ⅞ mile S.W. of Rothbury bridge.

Carboniferous, limestone near top of Cementstone Series, with algae (*Ortonella furcata*), worm-tubes (*Spirorbis*), etc.

Garwood, E. J. 1931, pp. 135-136. Fowler, A. 1936, p. 9.

Geol. Surv. N.S. 9; Ord. New Pop. 71.

**Rothbury.** Section in Forest Burn near East Row, 2¾ miles S.E. of Rothbury bridge.

Carboniferous, Middle Limestone Group; Eelwell Limestone ⅛ mile E. of East Row; "Red Bed" calcareous sandstone ⅛ mile further E. Crinoids, bryozoa, brachiopods, lamellibranchs, etc., occur.

Fowler, A. 1936, pp. 27-29.

Geol. Surv. N.S. 9; Ord. New Pop. 71.

**Scremerston**, 2½ miles S.S.E. of Berwick-on-Tweed. Coast-section from Hud's Head S.S.E. for 2¼ miles to Far Skerr and quarries immediately behind shore.

Carboniferous, Lower and Middle Limestone Groups, Dun to Sandbanks



**Backwell**, 7 miles S.W. of Bristol. Quarries in Cheston Coombe, near Backwell.

Carboniferous Limestone (S zone), with corals (*Lithostrotion*) and brachiopods (*Composita* [*Seminula*] *ficoidea*, *Productus*, etc.).

Wallis, F. S. 1922, pp. 210, 215, with geol. map.

Geol. Surv. O.S. 19 ; Ord. New Pop. 165.

**Banwell**, 3½ miles N.W. of Axbridge. Quarries on Banwell Hill, N.W. of Banwell Castle.

Carboniferous Limestone (C<sub>2</sub> subzone), with many corals and brachiopods.

Bamber, A. E. 1924, p. 87, with geol. map.

Geol. Surv. O.S. 19 ; Ord. New Pop. 165.

**Barrow Gurney**, 5 miles S.W. of Bristol. Dial Quarry, on S.E. side of Bristol-Bridgewater road, 1 mile S.W. of reservoirs.

Carboniferous Limestone (S<sub>2</sub> subzone), with corals (*Lithostrotion*) and brachiopods (*Composita* [*Seminula*] *ficoidea*, *Productus*, etc.).

Wallis, F. S. 1922, pp. 210, 213, with geol. map.

Geol. Surv. O.S. 19 ; Ord. New Pop. 165.

**Binegar**, 3½ miles N. of Shepton Mallet. Numerous quarries E. of the village.

Carboniferous Limestone (S and D zones) with corals (*Lithostrotion*, *Palaeosmilia*) and brachiopods.

Welch, F. B. A. 1929, pp. 48, 68, with geol. map.

Geol. Surv. O.S. 19 ; Ord. New Pop. 166.

**Bleadon**, 3½ miles S. of Weston-super-Mare. Small gravel-pit opposite Anchor Inn on main Bridgewater-Weston road, just S. of Bleadon.

Upper Pleistocene (talus-breccia on 50-ft. raised beach platform). A sandy basement-bed, 20 ft. below the surface, yields bones, mainly reindeer antlers (*Rangifer tarandus*) and vole-bones (*Microtus ratticeps*).

Palmer, L. S. 1930, p. 51.

Geol. Surv. O.S. 20 ; Ord. New Pop. 165.

**Blue Anchor**, 5 miles S.E. of Minehead. Reefs in foreshore at low tide.

Triassic, Rhaetic, with fish-remains (*Ceratodus*, etc.) in bone-bed and many lamellibranchs in hard bands, including forms rare elsewhere, such as *Pteromya crowcombeia*.

Richardson, L. 1911a, pp. 15-18, pl. II.

Geol. Surv. O.S. 20 ; Ord. New Pop. 164.

**Burrington**, 4½ miles N.E. of Axbridge. Natural exposures, screes and quarries in Burrington Combe, S.S.E. of the village.

Carboniferous Limestone (complete succession from K to D<sub>1</sub> zones). The full sequence of characteristic corals, brachiopods, etc., can be found.

Reynolds, S. H. and Vaughan, A. 1911, p. 342, with geol. map.

Geol. Surv. O.S. 110 ; Ord. New Pop. 165.

**Camerton**, 2 miles N.N.W. of Radstock. Tip-heap of Camerton Colliery.

Carboniferous, Coal Measures (Radstock Group), with abundant fossil plants, especially *Pecopteris* and rare non-marine shells (*Anthraconaia prolifera*).

Moore, L. R. and Trueman, A. E. 1937, p. 231. Moore, L. R. 1938, p. 294.

Geol. Surv. O.S. 19 ; Ord. New Pop. 166.

**Chesterblade**, 3 miles S.E. of Shepton Mallet. Alham Lane Quarry, on N. side of lane ¼ mile E. of Chesterblade, 2½ miles S.E. of Shepton Mallet station.

Jurassic, Fuller's Earth Rock, with many lamellibranchs, gastropods, etc.

Richardson, L. 1909, p. 212. Arkell, W. J. 1939c.

Geol. Surv. O.S. 19 ; Ord. New Pop. 166.



**Holford.** Quarry in angle between streams from Holford Combe and Hodders Combe. Station 5 of Hallam, 1934.

Middle Devonian, Hangman Grits, with numerous casts of gastropods.

Evans, J. W. and others 1914, p. 102. Hallam, A. D. 1934, p. 437, with sketch-maps.

Geol. Surv. N.S. 295 ; Ord. New Pop. 164.

**Holwell,** 3½ miles S.W. of Frome. Quarry on S. side of Shepton Mallet road immediately W. of Holwell.

Carboniferous Limestone (C<sub>2</sub>-S<sub>1</sub> subzones), with fissures filled with Rhaetic deposits. The source of the earliest British fossil mammal (*Hypsiprymnopsis rhaeticus*), the mammal-like reptile *Tritylodon* and abundant fish-scales and teeth ; all obtained by washing the fissure-filling material.

Moore, C. 1867. Richardson, L. 1911a, p. 63. Geol. map in Welch, F. B. A. 1933.

Geol. Surv. O.S. 19 ; Ord. New Pop. 166.

**Keynsham.** Keelings Quarry, Wellsway, Keynsham.

Jurassic, Lower Lias (*angulata* to *semicostatum* zones), with ammonites, other mollusca and brachiopods.

Tutcher, J. W. 1923, p. 271.

Geol. Surv. O.S. 19 ; Ord. New Pop. 155.

**Kilve,** 5 miles E.N.E. of Williton. Cliffs and foreshore, W. and E. of Kilve.

Jurassic, Lower Lias (*planorbis* to *semicostatum* zones), with abundant ammonites and many other fossils.

Woodward, H. B. 1893, pp. 92-95.

Geol. Surv. O.S. 20 ; Ord. New Pop. 164.

**Leigh-upon-Mendip,** 5 miles W. of Frome. Quarries of the Leigh-upon-Mendip Quarry Co.

Carboniferous Limestone (C<sub>2</sub>-S<sub>1</sub> subzones), with abundant corals and brachiopods.

Welch, F. B. A. 1933, p. 21, with geol. map.

Geol. Surv. O.S. 19 ; Ord. New Pop. 166.

**Leigh-upon-Mendip.** Tadhill, field near E. corner of Walltyning Plantation, 300 yds. S.S.W. of Tadhill Farm. Surface material.

Silurian, Upper Llandovery, fine volcanic tuff with corals, brachiopods, molluscs, trilobites, etc.

Reynolds, S. H. 1907, pp. 220, 226.

Geol. Surv. O.S. 19 ; Ord. New Pop. 166.

**Long Ashton,** 3 miles S.W. of Bristol. Exposures in Oxhouse Bottom and in lane S. of and parallel to this ravine.

Carboniferous Limestone (K zone), with brachiopods (*Camarotoechia*, *Avonia bassa*, spire-bearing forms, etc.).

Geol. Surv. O.S. 35 ; Ord. New Pop. 155 and 165.

**Long Ashton.** Quarry on N. side of Bristol-Cleveland road, E. of Ashton Park and N. of Providence.

Carboniferous Limestone (S zone), with corals (*Lithostrotion*) and brachiopods (*Composita* [*Seminula*] *ficoidea*, etc.).

Geol. Surv. O.S. 35 ; Ord. New Pop. 155 and 165.

**Maperton,** 3 miles S.W. of Wincanton. Road-cutting between Charlton Horethorne and Maperton, about ¼ mile S.S.W. of the latter.

Jurassic, Fuller's Earth Rock, with abundant brachiopods (*Ornithella*) and bryozoa (*Diastopora*) in top beds.

Richardson, L. 1909, p. 212.

Geol. Surv. O.S. 18 ; Ord. New Pop. 166.



**Maperton.** Dancing Cross Quarry,  $\frac{3}{4}$  mile N.N.W. of Maperton Church. Jurassic, Fuller's Earth Rock, with abundant corals, brachiopods, lamellibranchs and ammonites.

Richardson, L. 1909, p. 213. Kellaway, G. A. and Wilson, V. 1941, p. 178. Geol. Surv. O.S. 18 ; Ord. New Pop. 166.

**Marston Magna**, 5 miles N.N.E. of Yeovil. Bed of mill-stream about 700 yds. W. of the church.

Jurassic, Lower Lias (*obtusum* zone, "Marston Marble"), packed with small ammonites (*Promicroceras* and *Asteroceras*).

Kellaway, G. A. and Wilson, V. 1941, p. 142.

Geol. Surv. O.S. 18 ; Ord. New Pop. 166.

**Midford**,  $3\frac{1}{2}$  miles S. of Bath. Road-section  $\frac{1}{4}$  mile S. of Midford station.

Jurassic, Upper Lias (Midford Sands), Inferior Oolite and Fuller's Earth. All beds replete with fossils, especially corals and small brachiopods in top beds of Inferior Oolite.

Richardson, L. 1907, pp. 406-408.

Geol. Surv. O.S. 19 ; Ord. New Pop. 166.

**Midsomer Norton**,  $1\frac{1}{2}$  miles W. of Radstock. Tip-heap of Norton Hill Colliery.

Carboniferous, Coal Measures (Farrington Group), with fossil plants : *Sphenopteris*, etc., from roof of Big Seam ; *Mariopteris*, etc., from roof of New Vein ; *Neuropteris*, etc., from roof of Styving Vein.

Moore, L. R. and Trueman, A. E. 1937, pp. 229-230.

Geol. Surv. O.S. 19 ; Ord. New Pop. 166.

**Misterton**,  $1\frac{1}{2}$  miles S.E. of Crewkerne. Misterton Limeworks Quarry (disused).

Jurassic, Inferior Oolite (*opalinum* to *parkinsoni* zones), with abundant ammonites and lamellibranchs and a marl-bed near the top rich in microfossils.

Richardson, L. 1918, p. 154.

Geol. Surv. O.S. 18 ; Ord. New Pop. 177.

**North Coker**, 2 miles S.W. of Yeovil. Road-section near lodge about 350 yds. S.W. of N. Coker Mill, and small quarry in field 340 yds. W. of this road-section.

Jurassic, Cornbrash, with many brachiopods, resting on Forest Marble clay, with oysters.

Kellaway, G. A. and Wilson, V. 1941, p. 179.

Geol. Surv. O.S. 18 ; Ord. New Pop. 177.

**Nunney**, 3 miles S.W. of Frome. Large quarry near the village.

Carboniferous Limestone (C<sub>2</sub>-S<sub>1</sub> subzones), with corals and brachiopods.

Welch, F. B. A. 1933, p. 35, with geol. map.

Geol. Surv. O.S. 19 ; Ord. New Pop. 166.

**Portishead.** Cliffs and foreshore, Battery Point and Eastwood Ridge.

Carboniferous Limestone (K and Z zones). Good preparations can be made by dissolving silicified fossils out of the limestone with acid.

Reynolds, S. H. and Greenly, E. 1924, pp. 452-453, with geol. map.

Geol. Surv. O.S. 35 ; Ord. New Pop. 155.

**Seavington St. Mary**, 3 miles E. of Ilminster. Large quarry on hillside about 650 yds. S.S.W. of St. Mary's Church.

Jurassic, Inferior Oolite, with ammonites, lamellibranchs and brachiopods, and a thin algal band.

Geol. Surv. O.S. 18 ; Ord. New Pop. 177.

**Shepton Beauchamp**, 3 miles N.E. of Ilminster. Quarry 550 yds. W. of Hurcot Farm,  $\frac{1}{4}$  mile S.S.W. of Shepton Beauchamp.

Jurassic, Upper Lias clays, Junction Bed and Middle Lias, with abundant ammonites and other fossils.

Geol. Surv. O.S. 18 ; Ord. New Pop. 177.



**Shipham**, 2 miles N.E. of Axbridge. Natural exposures and quarries (Callow Rocks and Quarries) 1 mile S.S.E. of Shipham Church.

Carboniferous Limestone (C<sub>1</sub> subzone), with nautiloid cephalopods.

Wallis, F. S. 1935, p. 538.

Geol. Surv. O.S. 19 ; Ord. New Pop. 165.

**South Brewham**, 2½ miles E.N.E. of Bruton. Roadside quarry and road-cutting N. of Cards Farm, ¾ mile S. of S. Brewham Church.

Jurassic, Cornbrash, with abundant well-preserved lamellibranchs at top of Lower Cornbrash (*Astarte-Trigonia* bed).

Douglas, J. A. and Arkell, W. J. 1928, p. 144.

Geol. Surv. O.S. 19 ; Ord. New Pop. 166.

**South Cheriton**, 3½ miles S.W. of Wincanton. Quarry on W. side of road to N. Cheriton, ¼ mile N.W. of S. Cheriton Church.

Jurassic, Cornbrash, with brachiopods at base, ammonites (*Clydoniceras*) and lamellibranchs (*Astarte-Trigonia* bed) at top of Lower Cornbrash.

Douglas, J. A. and Arkell, W. J. 1928, p. 146.

Geol. Surv. O.S. 18 ; Ord. New Pop. 166.

**Stoford**, 2 miles S.S.W. of Yeovil. Small quarry in field, 150 yds. S.S.E. of Yeovil Junction.

Jurassic, Inferior Oolite (condensed and imperfect sequence), with ammonites, brachiopods, etc.

Kellaway, G. A. and Wilson, V. 1941, p. 150.

Geol. Surv. O.S. 18 ; Ord. New Pop. 177.

**Timberscombe**, S. of Minehead. Timberscombe.

Middle Devonian, Hangman Grits, with plant-remains.

Hicks, H. 1896, p. 361.

Geol. Surv. O.S. 20 ; Ord. New Pop. 164.

**Twerton**, S.W. suburb of Bath. Victoria Brick and Tile Works.

Pleistocene, about 10 ft. of gravel and loam of 100-ft. terrace of R. Avon, resting on Lower Lias clay, and yielding bones of elephant, mammoth, woolly rhinoceros, etc.

Palmer, L. S. 1930, p. 49.

Geol. Surv. O.S. 19 ; Ord. New Pop. 166.

**Uphill**, 2 miles S. of Weston-super-Mare. Brean Down, quarries W. of Uphill Church and cliff-exposures.

Carboniferous Limestone (Z-C<sub>2</sub> zones), with large corals (*Caninia*) and brachiopods.

Bamber, A. E. 1925, p. 85, with geol. map.

Geol. Surv. O.S. 20 ; Ord. New Pop. 165.

**Waterlip**, 2 miles N.E. of Shepton Mallet. Northern part of Willcox's Quarry, W. side of road.

Carboniferous Limestone (Z zone). Silicified fossils can be dissolved out with acid.

Welch, F. B. A. 1933, p. 18, with geol. map.

Geol. Surv. O.S. 19 ; Ord. New Pop. 166.

**Welton**, 1½ miles W. of Radstock. Bowldish Quarry, about 550 yds. N. of Welton station.

Jurassic, Lower Lias (condensed and broken sequence between *planorbis* and *ruricostatum* zones), with ammonites, belemnites and brachiopods (*Spiriferina walcotti*) abundant.

Tutcher, J. W. and Trueman, A. E. 1925, p. 608.

Geol. Surv. O.S. 19 ; Ord. New Pop. 166.

**West Chinnock**, 3 miles N.N.E. of Crewkerne. Quarry on S. side of road on Chiselborough Hill, 2050 yds. N.E. of St. Margaret's Church ; also another quarry on N. side of road.



Jurassic, Inferior Oolite (resting on Upper Lias, Ham Hill Stone). Brachiopods (*Homoeorhynchia cynocephala*, etc.) are common and an occasional ammonite occurs.

Kellaway, G. A. and Wilson, V. 1941, p. 180.

Geol. Surv. O.S. 18 ; Ord. New Pop. 155.

**Weston-in-Gordano**, 3 miles N.E. of Clevedon. Nightingale and Black Rock Quarries, N.E. and E. of the village.

Carboniferous Limestone (Z and C zones), with corals and brachiopods.

Reynolds, S. H. and Greenly, E. 1924, pp. 448, 450, with geol. map.

Geol. Surv. O.S. 35 ; Ord. New Pop. 155.

**Weston-super-Mare**. Spring Cove, 200 yds. N. of the pier.

Carboniferous Limestone (C<sub>1</sub> subzone). A bed composed almost entirely of the coral *Caninia subibicina* crops out in the cliff by path to shore.

Vaughan, A. 1905, p. 552.

Geol. Surv. O.S. 20 ; Ord. New Pop. 165.

**Wheddon Cross**, 5½ miles S.W. of Dunster. Middle Devonian, Ilfracombe Beds, with a varied coral fauna and some crinoids, brachiopods, etc.

Hicks, H. 1896, p. 364.

Geol. Surv. O.S. 20 ; Ord. New Pop. 164.

**Winford**, 6 miles S.W. of Bristol. Small quarry ½ mile S. of Winford, on Crown Hill, on W. side of lane about 300 yds. N. of Crown Inn.

Carboniferous, "Millstone Grit" with plentiful, but badly-preserved, goniatites.

Geol. Surv. O.S. 19 ; Ord. New Pop. 165.

**Withycombe**, 4 miles W. of Williton. Old quarries near Sandhill Farm, ½ mile S.E. of Withycombe.

Middle Devonian, Ilfracombe Beds, with a rich coral fauna.

Perceval, S. G. 1866.

Geol. Surv. O.S. 20 ; Ord. New Pop. 164.

**Wiveliscombe**, 9½ miles W.N.W. of Taunton. Quarries near Oakhampton House, 1¼ miles N. of Wiveliscombe.

Upper Devonian, Morte Slates, with brachiopods, lamellibranchs and trilobites.

Ussher, W. A. E. 1908, p. 27.

Geol. Surv. N.S. 295 ; Ord. New Pop. 164.

**Wrington**, 10 miles S.W. of Bristol. Quarries 300 yds. N.E. of Wrington at S. end of Prestow Wood opposite Branches Cross.

Carboniferous Limestone (D<sub>2</sub> subzone). A rich fauna of clisiophyllid and other corals and rare echinoderms (blastoids).

Geol. Surv. O.S. 19 ; Ord. New Pop. 165.

## STAFFORDSHIRE

**Biddulph**, 3 miles S.S.E. of Congleton (Cheshire). Spoil-heap from disused colliery at Woodhouse Lane, about 300 yds. S.E. of Woodhouse Farm and 700 yds. N.E. of the Oxhay, on lane to Biddulph Moor.

Carboniferous, Coal Measures (*lenisulcata* zone, marine band in roof of Crabtree Coal), with solid goniatites (*Gastrioceras listeri*).

Geol. Surv. N.S. 110 ; Ord. New Pop. 110.

**Brindley Ford**, 3 miles N.N.E. of Tunstall. Right bank of R. Trent in Lion's Paw Wood, 170 yds. W.N.W. of Lion's Paw Farm and 760 yds. N.N.E. of Judgefields.

Carboniferous, Millstone Grit (G zone), with abundant goniatites (*Gastrioceras cancellatum*) and lamellibranchs.

Geol. Surv. N.S. 110 and 123 ; Ord. New Pop. 110.



**Cracoe**, 5½ miles N. of Skipton. Disused quarries and a stream-section in Skelterton Beck.

Carboniferous Limestone (knoll-reef of  $S_2D_1$  subzones in quarries, followed by limestones and shales of  $P_1$  subzone in stream); corals (*Lithostrotion*, *Caninia*) in reef; corals and goniatites in the  $P_1$  shales.

Booker, K. M. and Hudson R. G. S. 1926, with geol. map.

Geol. Surv. O.S. 92 N.E.; Ord. New Pop. 95.

**Eastby**, 3½ miles N.E. of Skipton. Stream-section in Heugh (Gill Eastby Beck), 900 yds. N.E. of Embsay Church and 250 yds. N. of Eastby Bridge. (Localities 7-11 of Hudson & Mitchell, 1937.)

Carboniferous, Bowland Shales ( $P_2$  and  $E_1$  subzones); shale containing many goniatites, mostly crushed.

Hudson, R. G. S. and Mitchell, G. H. 1937, with geol. map.

Geol. Surv. O.S. 92 N.E.; Ord. New Pop. 96.

**Feizor**, 1½ miles E.S.E. of Austwick. Natural scars.

Carboniferous, Lower Yoredale Series; corals (*Lonsdaleia* and *Orionastraea*) are common.

Geol. Surv. O.S. 92 N.W.; Ord. New Pop. 90.

**Gargrave**, 4½ miles W.N.W. of Skipton. West side of Butterhaw Quarry (disused), east of railway south of Gargrave.

Carboniferous Limestone ( $C_2S_1$  zone); bedded limestones and pebble-beds, containing abundant zaphrentid and other corals.

Hudson, R. G. S. 1944, p. 205, with geol. map.

Geol. Surv. O.S. 92 N.W.; Ord. New Pop. 95.

**Giggleswick**. Blackrigg Quarry at top of Buckhaw Brow on east side of main Settle-Kirby Lonsdale road.

Carboniferous ( $D_2$  subzone, upper beds of Great Scar Limestone); containing algal nodules (*Girvanella*) and corals (*Lonsdaleia*).

Geol. Surv. O.S. 92 N.W.; Ord. New Pop. 90.

**Greenhow**, 3 miles W.S.W. of Pateley Bridge. Coldstone Quarries. (Locality 10 of Dunham and Stubblefield 1944.)

Carboniferous Limestone ( $D_2$  subzone, Coldstone Limestone); containing corals (*Lonsdaleia*, *Palaeosmilia*, *Dibunophyllum*, etc.) and productid brachiopods.

Dunham, K. C. and Stubblefield, C. J. 1944, p. 222, with geol. map.

Geol. Surv. O.S. 92 N.E.; Ord. New Pop. 96.

**Halton East**. Halton East Quarries, the western quarry, N.W. of New Laithe and E.N.E. of Embsay Station. (Locality 91 of Hudson & Mitchell, 1937.)

Carboniferous Limestone (Embsay Limestone,  $C_2S_1$  subzone); zaphrentid corals.

Hudson, R. G. S. and Mitchell, G. H. 1937, with geol. map.

Geol. Surv. O.S. 92 N.E.; Ord. New Pop. 96.

**Hampole**. Moorhouse Lane Quarries, 1000 yds. E. of Moorhouse, Hampole.

Permian, Lower Magnesian Limestone; oolites, containing well-preserved lamellibranchs (*Schizodus*).

Kendall, P. F. and Wroot, H. E. 1924, p. 917.

Geol. Surv. N.S. 87; Ord. New Pop. 91.

**Hampole**. Oak Bank Quarry, 150 yds. W.N.W. of Hampole station.

Permian, Lower Magnesian Limestone; reef limestone containing brachiopods and bryozoa.

Geol. Surv. N.S. 87; Ord. New Pop. 91.



Lower Calcareous Grit) ; echinoderms abundant in the impure oolites. The brachiopod *Thurmanella* and various lamellibranchs found in the grits below ; also the microscopic spicules of the sponge *Rhaxella*.

Blake, J. F. and Hudleston, W. H. 1877, p. 363 ; Wilson, V. 1933, pp. 490, 498 ; 1936, p. 264, with geol. map.

Geol. Surv. N.S. 53 ; Ord. New Pop. 92.

**Arkengarthdale**, 11 miles S.E. of Brough. Stream-section in Mirk Fell Beck, south of Mirk Fell Bridge, near Tan Hill Colliery.

Upper Carboniferous (Mirk Fell Beds, E<sub>2</sub> subzone) ; abundant zaphrentid corals, goniatites (*Cravenoceras*), lamellibranchs (*Nuculopsis*), etc., in ironstone beds.

Hudson, R. G. S. 1941, p. 259. Chubb, L. J. and Hudson, R. G. S. 1923, p. 274.

Geol. Surv. O.S. 97 N.W. ; Ord. New Pop. 84.

— **Askrigg**, Wensleydale, 12 miles W. of Leyburn. Stream-section in Arn Gill, 1400 yds. N.N.E. of Askrigg Church.

Carboniferous, Yoredale Beds (Middle Limestone and shales, D<sub>2</sub> subzone) ; corals (*Orionastraea*, *Lithostrotion*) at base of, and brachiopods (*Gigantoproductus*) in, Middle Limestone with sponges in shale-parting (*Erythrospongia lithodes*). Zaphrentid corals in overlying shales.

Hudson, R. G. S. 1929, p. 181. Hudson, R. G. S. and King, W. B. R. 1933, p. 429. Hudson, R. G. S. and Fox, T. 1943, p. 101.

Geol. Surv. O.S. 97 N.W. ; Ord. New Pop. 90.

**Askrigg**. Stream-section, Grange Gill, from below Bow Bridge upstream to Abbey Force, on both sides of Askrigg-Sedbergh road.

Carboniferous, Yoredale Series (Gayle Limestone and Shale, D<sub>1-2</sub> subzones) ; algal nodules (*Girvanella*) below Bow Bridge ; corals (*Lithostrotion*) between Hockett and Bow Bridge ; and corals (*Aulophyllum*, *Zaphrentis*) with brachiopods at Abbey Force.

Hudson, R. G. S. and King, W. B. R. 1933, pp. 429, 431.

Geol. Surv. O.S. 97 N.W. ; Ord. New Pop. 90.

**Askrigg**. Stream-section, lower part of Mill Gill, about half-a-mile W.N.W. of Askrigg Church.

Carboniferous, Yoredale Series (Gayle Limestone and Hardraw Shale, D<sub>1</sub> subzone) ; brachiopods (*Chonetes*, *Gigantoproductus*) in limestone ; productids, lamellibranchs (*Posidonia*) and goniatites in shale.

Hudson, R. G. S. and others 1933, p. 227. Hudson, R. G. S. and King, W. B. R. 1933, p. 429.

Geol. Surv. O.S. 97 N.W. ; Ord. New Pop. 90.

**Aysgarth**, Wensleydale, 7½ miles W. of Leyburn. Section in left bank of stream by bridge at Aysgarth Falls.

Carboniferous, Yoredale Series (Gayle Shale and Limestone, D<sub>1</sub> subzone) ; corals (*Aulophyllum* and zaphrentids) and brachiopods common in the Gayle Shale.

Hudson, R. G. S. and King, W. B. R. 1933, p. 432.

Geol. Surv. O.S. 97 S.E. ; Ord. New Pop. 90.

**Boltby**, 5 miles N.E. of Thirsk. Natural exposure below Boltby Scar, about 1 mile S.E. of Boltby village.

Jurassic, Oxford Clay (15-20 ft.) on Kellaways Rock ; ammonites very common in the Oxford Clay.

Geol. Surv. N.S. 52 ; Ord. New Pop. 91.

**Burniston**, 5 miles N. of Scarborough. Coast section in Burniston Wyke and at Cromer Point.

Jurassic, Inferior Oolite, sandstones of Middle Estuarine Series and the Scalby Plant Bed just S. of Cromer Point ; footprints of small dinosaurs in



Lower Calcareous Grit) ; echinoderms abundant in the impure oolites. The brachiopod *Thurmanella* and various lamellibranchs found in the grits below ; also the microscopic spicules of the sponge *Rhaxella*.

Blake, J. F. and Hudleston, W. H. 1877, p. 363 ; Wilson, V. 1933, pp. 490, 498 ; 1936, p. 264, with geol. map.

Geol. Surv. N.S. 53 ; Ord. New Pop. 92.

**Arkengarthdale**, 11 miles S.E. of Brough. Stream-section in Mirk Fell Beck, south of Mirk Fell Bridge, near Tan Hill Colliery.

Upper Carboniferous (Mirk Fell Beds, E<sub>2</sub> subzone) ; abundant zaphrentid corals, goniatites (*Cravenoceras*), lamellibranchs (*Nuculopsis*), etc., in ironstone beds.

Hudson, R. G. S. 1941, p. 259. Chubb, L. J. and Hudson, R. G. S. 1923, p. 274.

Geol. Surv. O.S. 97 N.W. ; Ord. New Pop. 84.

**Askrigg**, Wensleydale, 12 miles W. of Leyburn. Stream-section in Arn Gill, 1400 yds. N.N.E. of Askrigg Church.

Carboniferous, Yoredale Beds (Middle Limestone and shales, D<sub>2</sub> subzone) ; corals (*Orionastraea*, *Lithostrotion*) at base of, and brachiopods (*Gigantoproductus*) in, Middle Limestone with sponges in shale-parting (*Erythrospongia lithodes*). Zaphrentid corals in overlying shales.

Hudson, R. G. S. 1929, p. 181. Hudson, R. G. S. and King, W. B. R. 1933, p. 429. Hudson, R. G. S. and Fox, T. 1943, p. 101.

Geol. Surv. O.S. 97 N.W. ; Ord. New Pop. 90.

**Askrigg**. Stream-section, Grange Gill, from below Bow Bridge upstream to Abbey Force, on both sides of Askrigg-Sedbergh road.

Carboniferous, Yoredale Series (Gayle Limestone and Shale, D<sub>1-2</sub> subzones) ; algal nodules (*Girvanella*) below Bow Bridge ; corals (*Lithostrotion*) between Hockett and Bow Bridge ; and corals (*Aulophyllum*, *Zaphrentis*) with brachiopods at Abbey Force.

Hudson, R. G. S. and King, W. B. R. 1933, pp. 429, 431.

Geol. Surv. O.S. 97 N.W. ; Ord. New Pop. 90.

**Askrigg**. Stream-section, lower part of Mill Gill, about half-a-mile W.N.W. of Askrigg Church.

Carboniferous, Yoredale Series (Gayle Limestone and Hardraw Shale, D<sub>1</sub> subzone) ; brachiopods (*Chonetes*, *Gigantoproductus*) in limestone ; productids, lamellibranchs (*Posidonia*) and goniatites in shale.

Hudson, R. G. S. and others 1933, p. 227. Hudson, R. G. S. and King, W. B. R. 1933, p. 429.

Geol. Surv. O.S. 97 N.W. ; Ord. New Pop. 90.

**Aysgarth**, Wensleydale, 7½ miles W. of Leyburn. Section in left bank of stream by bridge at Aysgarth Falls.

Carboniferous, Yoredale Series (Gayle Shale and Limestone, D<sub>1</sub> subzone) ; corals (*Aulophyllum* and zaphrentids) and brachiopods common in the Gayle Shale.

Hudson, R. G. S. and King, W. B. R. 1933, p. 432.

Geol. Surv. O.S. 97 S.E. ; Ord. New Pop. 90.

**Boltby**, 5 miles N.E. of Thirsk. Natural exposure below Boltby Scar, about 1 mile S.E. of Boltby village.

Jurassic, Oxford Clay (15-20 ft.) on Kellaways Rock ; ammonites very common in the Oxford Clay.

Geol. Surv. N.S. 52 ; Ord. New Pop. 91.

**Burniston**, 5 miles N. of Scarborough. Coast section in Burniston Wyke and at Cromer Point.

Jurassic, Inferior Oolite, sandstones of Middle Estuarine Series and the Scalby Plant Bed just S. of Cromer Point ; footprints of small dinosaurs in



**Barr.** Section at foot of rivulet 100 yds. S. of E. limit of Blackwood Head Plantation,  $3\frac{1}{2}$  miles N.N.W. of Barr.

Silurian, Llandovery (Bargany Group), 100 yds. S. of faulted junction with Carboniferous, yields corals, trilobites, brachiopods and plants.

Peach, B. N. and Horne, J. 1899, p. 546.

Geol. Surv. 8 ; Ord. Pop. 82.

**Barrhill.** Cross Water (which joins Duisk Water at Barrhill), at a point above Linn Dubh,  $\frac{3}{4}$  mile S.W. of Barrhill and 400 yds. S.S.E. of Ward.

Ordovician, Caradoc (Glenkiln shales) with graptolites.

Peach, B. N. and Horne, J. 1899, p. 417.

Geol. Surv. 8 ; Ord. Pop. 82.

**Beith.** Broadstone Quarry, 1 mile E.S.E. of Beith.

Carboniferous, Lower Limestone Series (Broadstone or Blackbyre Limestone), with corals, brachiopods, lamellibranchs, arthropods and fish-remains.

Richey, J. E. and others 1930, pp. 144-145. Hill, D. 1937-1941, p. 21.

Geol. Surv. 22 ; Ord. Pop. 72.

**Beith.** Quarry a little N. of Trearne House, Gateside,  $1\frac{1}{4}$  miles E. of Beith.

Carboniferous, Lower Limestone Series (Broadstone Limestone), with corals, bryozoa, productid brachiopods, etc.

Richey, J. E. and others 1930, p. 146. Hill, D. 1937-1941, p. 23.

Geol. Surv. 22 ; Ord. Pop. 72.

**Beith.** Section in Dusk Water, 20 yds., 330 yds. and 440 yds. below Hessilhead Bridge,  $2\frac{1}{4}$  miles E.S.E. of Beith.

Carboniferous, Lower Limestone Series (Dockra and Hosie Limestones) with productid and other brachiopods, and gastropods.

Richey, J. E. and others 1930, pp. 142, 146, 148.

Geol. Surv. 22 ; Ord. Pop. 72.

**Beith.** Dockra Quarry,  $1\frac{1}{4}$  miles S.E. of Beith.

Carboniferous, Lower Limestone Series (Dockra Limestone), with corals, productid brachiopods and lamellibranchs.

Richey, J. E. and others 1930, pp. 146-147.

Geol. Surv. 22 ; Ord. Pop. 72.

**Benquhat.** Gully 1 mile, 300 yds. S.E. of E. end of Benquhat.

Carboniferous, Coal Measures (Skipsey's Marine Band), with *Lingula* and productid brachiopods, lamellibranchs and gastropods.

Geol. Surv. 14 ; Ord. Pop. 83.

**Beoch.** Black Water,  $1\frac{1}{4}$  miles W.  $5^{\circ}$  N. of Beoch Cottages, at the Chalybeate Springs 5 miles S.W. of Ayr.

Carboniferous, Coal Measures, with non-marine shells.

Geol. Surv. 14 ; Ord. Pop. 83.

**Bowerhill.** Shore 100 yds., 150 yds. and 180 yds. N.W. of Bowerhill,  $3\frac{1}{2}$  miles W.  $40^{\circ}$  S. of Ayr ; also reefs 300 yds. N.E. of Bowerhill.

Carboniferous, Cementstone Series, with lamellibranchs, ostracods, fish-remains, etc.

Geol. Surv. 14 ; Ord. Pop. 78.

**Busby.** 7 miles S. of Glasgow. Thornton Quarry, 2 miles S.E. of Busby.

Carboniferous, Lower Limestone Series (Main = Hurlet Limestone), with corals, productid brachiopods, molluscs, etc.

Richey, J. E. and others 1930, pp. 165-167.

Geol. Surv. 22 ; Ord. Pop. 72.

**Carsphairn.** Garryhorn Burn, 150 yds. S.E. of Garryhorn Farm and a few yards further downstream, 1 mile W. of Carsphairn.

Ordovician, Caradoc (Glenkiln black shale), with graptolites.

Peach, B. N. and Horne, J. 1899, pp. 378-379.

Geol. Surv. 8 ; Ord. Pop. 83.



**Sorn.** Bed of R. Ayr. N. of Upper Heilar and at confluence with small stream  $\frac{1}{2}$  mile W.  $41^{\circ}$  S. of Upper Heilar,  $2\frac{3}{4}$  miles E. of Sorn.

Carboniferous, Lower Limestone Series, Johnstone Shell Bed and Limestone Coal Series, with bryozoa, brachiopods and lamellibranchs.

Geol. Surv. 14 ; Ord. Pop. 78.

**Sorn.** Bank of Cleugh Burn at disused quarry S.E. of Blairmulloch and in bank of Burn 500 yds. E. of Blairmulloch,  $1\frac{3}{4}$  miles N. of Sorn.

Carboniferous, limestone with crinoids and brachiopods.

Geol. Surv. 14 ; Ord. Pop. 78.

**Sorn.** Bank and bed of R. Ayr, Glenlogan Bridge and 100 yds. above bridge in middle of Sorn.

Carboniferous, limestone with corals, brachiopods, lamellibranchs and trilobites.

Geol. Surv. 14 ; Ord. Pop. 78.

**Sorn.** Bank of burn 335 yds. S.E. and 665 yds. S.  $34^{\circ}$  E. of Nethershield and 554 yds. S.  $42^{\circ}$  E. of Nethershield ; also in bank of R. Ayr 716 yds. S.  $37^{\circ}$  W. and 780 yds. S.  $30^{\circ}$  E. of Nethershield, 2 miles E.N.E. of Sorn.

Carboniferous, Calciferous Sandstone and Lower Limestone Series, with corals, brachiopods, lamellibranchs and gastropods.

Geol. Surv. 14 ; Ord. Pop. 78.

**Stewarton.** Burn Annick Water at Laigh Clunch,  $2\frac{3}{4}$  miles N.E. of Stewarton, and in bank of westmost stream 40 yds. above bridge and 110 yds. W.  $24^{\circ}$  N. of Laigh Clunch, 3 miles N. of Fenwick.

Carboniferous, Lower Limestone Series (Hosie Limestone), with brachiopods, lamellibranchs and cephalopods.

Richey, J. E. and others 1930, pp. 157-159.

Geol. Surv. 22 ; Ord. Pop. 72.

**Straiton.** Quarry just N. of road 700 yds. W.  $10^{\circ}$  N. from Knockgardner Farm and about  $2\frac{1}{2}$  miles W.S.W. of Straiton ; and quarry S. of road 400 yds. E.  $10^{\circ}$  N. of Knockgardner and about 2 miles W.  $30^{\circ}$  S. of Straiton.

Silurian, Wenlock (Blair, Knockgardner and Straiton Beds), with corals, brachiopods, lamellibranchs and trilobites.

Geol. Surv. 14 ; Ord. Pop. 83.

**Waterside.** At intake for small dam by prominent bend in Dunaskin Glen ; left bank 150 yds. below entrance of Corbie Craigs Burn ; bluff on right bank 130 yds. below Corbie Craigs Burn ; left bank 200 yds. below dam ; bluff on right bank of Corbie Craigs Burn 100 yds. above junction with Dunaskin Glen.

Carboniferous, Coal Measures, with plants and non-marine shells.

Geol. Surv. 14 ; Ord. Pop. 83.

**Waterside.** Keirs Limeworks, about 700 yds. S.  $30^{\circ}$  E. of Keirs Farm and  $\frac{1}{4}$  mile S.  $20^{\circ}$  W. of Waterside ; about 860 yds. S.  $38^{\circ}$  E. of Farm and just E. of wall in old quarry ; old quarry 800 yds. S.  $40^{\circ}$  E. of Farm and just W. of wall ;  $3\frac{1}{2}$  miles W.  $30^{\circ}$  N. of Dalmellington.

Carboniferous, Upper Limestone Series (First Limestone), with corals and productid brachiopods.

Geol. Surv. 14 ; Ord. Pop. 83.

## BANFFSHIRE

**Fochabers.** Tynet Burn at double bend immediately below old sawmill 600 yds. N. of road bridge. Best locality in right bank at top of cliff, but fossils may be obtained in left bank about 100 yds. W. of sawmill.



Middle Old Red Sandstone (Tynet Fish-Bed), with well-preserved crossopterygian fish (*Osteolepis*, *Diplopterax*, *Glyptolepis*), acanthodians (*Diplacanthus*, *Cheiracanthus*, *Mesacanthus*) and placoderms (*Coccosteus*, *Pterichthyodes* and the very rare *Rhamphodopsis*).

Agassiz, L. 1844-1845.

Geol. Surv. 95 ; Ord. Pop. 29.

**Gardenstown of Gamrie.** Den of Findon, 200 yds. S.W. of Findon Farm, about 300 yds. N.W. of Dubford crossroads, on N.E. edge of ravine and in grassy slopes above.

Middle Old Red Sandstone, about 6 feet of clays and limestone-nodules resting on conglomerate. The nodules yield fish, including acanthodians (*Diplacanthus*, *Cheiracanthus*), placoderms (*Coccosteus decipiens*, *Pterichthyodes*), crossopterygians (especially *Glyptolepis*) and *Cheirolepis*.

Read, H. H. 1923, p. 171.

Geol. Surv. 96 ; Ord. Pop. 30.

## BERWICKSHIRE

**Allanton.** Blackadder Water above bridge at Allanton, 1½-1½ miles S.S.W. of Chirnside.

Carboniferous, Cementstone and Calciferous Sandstone Series, with plants and fish-remains.

Geol. Surv. 34 ; Ord. Pop. 75.

**Allanton.** Whiteadder Water above and below Allanton bridge and on right bank ¾ and 1 mile E. of bridge, 1½ miles S. of Chirnside.

Carboniferous, Cementstone Series, with lamellibranchs, arthropods and fish and plant remains.

Geol. Surv. 34 ; Ord. Pop. 75.

**Berwick-on-Tweed.** Shore between Needles Eye and St. John's Haven, N. of Berwick.

Carboniferous, limestone with productid brachiopods and corals.

Geol. Surv. 34 ; Ord. Pop. 75.

**Cockburnspath.** Siccar Point, E. side, and old slate quarry to the S.W., 250 yds. N.E. of farmhouse, E. of Cockburnspath.

Silurian, Llandovery (Tarannon flaggy shales) with graptolites and fossil tracks.

Peach, B. N. and Horne, J. 1899, p. 209.

Geol. Surv. 34 ; Ord. Pop. 75.

**Cockburnspath.** Landslip on shore W. of Old Cambus Burn, 2½ miles E. of Cockburnspath.

Upper Old Red Sandstone with fish-remains.

Geol. Surv. 34 ; Ord. Pop. 75.

**Cockburnspath.** Shore from Coastguard Station to Meikle Poo Craig, 3 miles E. of Cockburnspath.

Upper Old Red Sandstone with fish-remains.

Geol. Surv. 34 ; Ord. Pop. 75.

**Cockburnspath.** Shore midway between Pease Burn and Greenheugh Point, 1½ miles E. of Cockburnspath.

Upper Old Red Sandstone with fish-remains.

Geol. Surv. 34 ; Ord. Pop. 75.

**Cockburnspath.** Sections 50, 230, 300 and 400 yds. E.S.E. of entrance to Cove Harbour, Cockburnspath.

Carboniferous, Calciferous Sandstone Series, with plant remains.

Geol. Surv. 34 ; Ord. Pop. 75.



**Broxburn.** Shore opposite the Vaults, 2 miles E. of Dunbar.

Carboniferous, Lower Limestone Series, with corals, crinoids, brachiopods and molluscs.

Clough, C. T. and others 1910, p. 138.

Geol. Surv. 33 ; Ord. Pop. 75.

**Cockburnspath.** Shore E. of and 90 yds. N.W. of mouth of Bilsdean Creek, 7 miles S.E. of Dunbar.

Carboniferous, Calciferous Sandstone Series, with plants.

Clough, C. T. and others 1910, pp. 45-47.

Geol. Surv. 33 ; Ord. Pop. 75.

**Dunbar.** E. side of Belhaven Bay, W. of Dunbar.

Carboniferous, Calciferous Sandstone Series and Cementstone Series, with lamellibranchs and phyllopod crustacea.

Clough, C. T. and others 1910, p. 89.

Geol. Surv. 33 ; Ord. Pop. 75.

**Dunbar.** Shore 130 yds. N.E. of Catcraig Houses.

Carboniferous, Lower Limestone Series, with foraminifera, corals, brachiopods, molluscs, etc.

Clough, C. T. and others 1910, pp. 135-137. Hill, D. 1937-1941, p. 22.

Geol. Surv. 33 ; Ord. Pop. 75.

**Dunbar.** East Barns Quarry, 2 miles E. of Dunbar.

Carboniferous, Lower Limestone Series, with corals, brachiopods, molluscs, etc.

Geol. Surv. 33 ; Ord. Pop. 75.

**Dunbar.** Oxwell Mains Quarry, E. of Dunbar.

Carboniferous, Lower Limestone Series, with corals, brachiopods, molluscs, etc.

Clough, C. T. and others 1910, pp. 137, 213.

Geol. Surv. 33 ; Ord. Pop. 75.

**East Salton.** N.W. bank of Lammerlaw Burn, 700 yds. N. of Friar's Nose.

Ordovician, Caradoc (Hartfell shales), with graptolites.

Clough, C. T. and others 1910, pp. 116-117.

Geol. Surv. 33 ; Ord. Pop. 74.

**East Salton.** Salton Limeworks Quarries, E. and W. of road at Middlemains Farm, 1 mile N.W. of E. Salton.

Carboniferous, Lower Limestone Series, with corals, bryozoa, brachiopods, lamellibranchs and ostracods.

Clough, C. T. and others 1910, p. 211.

Geol. Surv. 33 ; Ord. Pop. 74.

**East Salton.** Spilmersford Quarry, 2 miles W. of E. Salton.

Carboniferous, Lower Limestone Series, with brachiopods, bryozoa, molluscs, etc.

Clough, C. T. and others 1910, p. 143.

Geol. Surv. 33 ; Ord. Pop. 74.

**East Salton.** Blanceburn Quarry, 1 mile N.E. of E. Salton.

Carboniferous, Lower Limestone Series, with corals, brachiopods, and lamellibranchs.

Clough, C. T. and others 1910, p. 210.

Geol. Surv. 33 ; Ord. Pop. 74.

**East Salton.** Kidlaw Quarries, 3½ miles S.E. of E. Salton.

Carboniferous, Lower Limestone Series, with echinoderms, bryozoa, brachiopods, molluscs and ostracods.

Clough, C. T. and others 1910, p. 212.

Geol. Surv. 33 ; Ord. Pop. 74.



**Avonbank.** Hamilton High Parks ; a short deep gully on W. bank of River Avon a little N. of W. of Avonbank ; on both E. and W. sides of a N.-S. fault crossing the gully.

Carboniferous, Coal Measures (*similis-pulchra* zone ; Skipsey's Marine Band) ; yields plants, lamellibranchs, brachiopods and goniatites.

Clough, C. T. and others 1920, p. 100.

Geol. Surv. 23 ; Ord. Pop. 73.

**Bothwell.** Left bank of River Clyde,  $\frac{1}{4}$  mile W. of Bothwell Bridge.

Carboniferous, Coal Measures (upper *similis-pulchra* or *phillipsi* zone) ; green shales in Barren Red Measures ; contain *Anthraconaia pruvosti* and *A. glotae*.

Weir, J. and Leitch, D. 1936, pp. 914 and 944-945.

Geol. Surv. 31 ; Ord. Pop. 73.

**Braidwood.** Fiddler Burn ; in gully on right bank below Fiddler Bridge and E.N.E. of Woodhall.

Carboniferous, Calciferous Sandstone Series (white shelly limestone above *Productus giganteus* Limestone) ; contains plants and brachiopods.

Hinxman, L. W. and others 1921, pp. 10-13. Hill, D. 1937-1941, p. 21.

Geol. Surv. 23 ; Ord. Pop. 73.

**Braidwood.** In bed of Fiddlers Burn below fall, 15-20 yds. upstream from Sampsons Slingstone.

Carboniferous, Limestone Coal Group (Slingstone Limestone) ; contains brachiopods and lamellibranchs.

Hinxman, L. W. and others 1921, p. 34.

Geol. Surv. 23 ; Ord. Pop. 73.

**Carluke.** Bed of Fiddlers Burn at Nellfield ; also on left bank of burn under the farmhouse ; also  $\frac{1}{4}$  mile N.E. of Nellfield ; also  $\frac{1}{12}$ th mile E.S.E. of Nellfield.  $1\frac{1}{2}$  miles S.E. of Carluke.

Carboniferous, Calciferous Sandstone Series (Fiddler Shell Bed ; limestones and shales) ; containing brachiopods, corals, gastropods and echinoderms.

Hinxman, L. W. and others 1921, pp. 10-13.

Geol. Surv. 23 ; Ord. Pop. 73.

— **Carluke.** In bed of Fulwood Burn, at point due W. of Birkenhead ;  $3\frac{1}{2}$  miles S.E. of Carluke.

Carboniferous, Calciferous Sandstone Series (*Productus giganteus* Limestone) ; contains brachiopods and corals.

Hinxman, L. W. and others 1921, p. 14.

Geol. Surv. 23 ; Ord. Pop. 73.

**Carluke.** Thorn Quarry, 2 miles N.E. of Carluke.

Carboniferous, Lower Limestone Group (Main Limestone) ; contains brachiopods, lamellibranchs, trilobites, cephalopods and fish remains.

Hinxman, L. W. and others 1921, pp. 27-28.

Geol. Surv. 23 ; Ord. Pop. 73.

— **Carluke.** Birkfield, 1 mile E.S.E. of Carluke ; quarry on left bank of Fiddlers Burn ; old quarry in spruce plantation on W. side of burn,  $\frac{1}{12}$ th mile S. of Birkfield ; and old ironstone workings,  $\frac{1}{12}$ th mile E. of Birkfield.

Carboniferous (shale with First Calmy Limestone) ; contains ostracods, productids and lamellibranchs.

Hinxman, L. W. and others 1921, p. 32.

Geol. Surv. 23 ; Ord. Pop. 73.

**Carluke.** Hallcraig House,  $1\frac{1}{2}$  miles W. of Carluke ; cliff under the house and on left bank of Jocks Burn below house and also opposite to it ; on left bank of burn below Hallcraig Bridge.



**East Kilbride.** Arrotshole Farmhouse ; old quarry at the farmhouse and above it in bed of Kittock Water ;  $1\frac{1}{2}$  miles W. by N. of East Kilbride Church.

Carboniferous, Calciferous Sandstone Series, and Main Limestone of Lower Limestone Group ; containing brachiopods, plants, fish remains and ostracods.

Carruthers, R. G. and Dinham, C. H. 1917, p. 15.

Geol. Surv. 23 ; Ord. Pop. 72.

**East Kilbride.** Basket Farmhouse ; left bank of Calder Water nearly opposite farmhouse, and  $\frac{1}{8}$  mile N.W. of it ; at stream level in W. bank of Rotten Calder, between East Kilbride and Blantyre ; also on right bank of Rotten Calder, about  $\frac{1}{8}$  mile S.S.W. of Basket.

Carboniferous, Calciferous Sandstone Series ; containing brachiopods, lamellibranchs, plants and crustaceans.

Carruthers, R. G. and Dinham, C. H. 1917, pp. 5-10.

Geol. Surv. 23 ; Ord. Pop. 72.

**Glenboig.** Moulding Sand Quarry,  $1/16$ th mile W. of Gain, about 1 mile N.N.E. of Glenboig railway station.

Carboniferous, Millstone Grit ; contains lamellibranchs, brachiopods and gastropods.

Clough, C. T. and others 1926, pp. 37-39.

Geol. Surv. 31 ; Ord. Pop. 73.

**Glenbuck.** Galawhistle Burn ; in small burn entering Galawhistle Burn,  $\frac{1}{4}$  mile W. of High Monkshead,  $1\frac{1}{4}$  miles N.N.W. of Glenbuck.

Carboniferous, Limestone Coal Group (Johnstone Shell Bed) ; Lower Limestones (Main Limestone) ; Calciferous Limestone Series ; contain brachiopods, corals, bryozoa, lamellibranchs and gastropods.

Geol. Surv. 23 ; Ord. Pop. 79.

**Glespin.** Carmacoup Burn ; 350 yds., 300 yds., 250 yds., 80 yds., 34 yds. and 20 yds. upstream from junction with small burn, entering from south at a point 667 yds. E.  $15^\circ$  S. of the N.W. corner of the 6-inch map.

Carboniferous, Lower Limestone Series ; contains brachiopods and corals.

Geol. Surv. 15 ; Ord. Pop. 79.

**Glespin.** Glentaggart Burn : (1) on lower side of road-bridge at Glentaggart House ; (2)  $\frac{1}{3}$  mile E.N.E. of house ; (3) scaur on right bank, 100-120 yds. upstream from Blackmire Burn ; (4) scaur on right bank,  $\frac{1}{3}$  mile upstream from junction with Glespin Burn ; and (5) left bank, 50-60 yds. upstream from coal worked at outcrop.

Carboniferous, Lower Limestone Series and (?) "Millstone Grit" ; the former contains corals, brachiopods and *Phillipsia*, and the latter plants.

Geol. Surv. 15 ; Ord. Pop. 79.

**Kennox (Douglas).** Kennox Water, right bank tributary, 500 yds. S.  $23^\circ$  E. of Kennox Farm.

Carboniferous, Coal Measures (*communis* zone) ; siltstones and shales exposed in right bank, the latter containing well-preserved solid shells of *Carbonicola* aff. *communis*, etc., and *Anthraconauta*.

Weir, J. and Leitch, D. 1936, p. 716 ; MacLennan, R. M. 1946, pp. 81-82.

Geol. Surv. 15 ; Ord. Pop. 79.

**Kennoxhead.** Kennox Water : (1) in bed of stream, 700 yds. E.  $23^\circ$  S. of Chapel Hill ; (2) high up on left bank, 600 yds. E.  $32^\circ$  S. of Chapel Hill ; (3) in sharp bend of stream, N.  $38^\circ$  W. of Kennox Hill and 250 yds. up from same bend. One mile E.N.E. of Kennoxhead.

Carboniferous, Upper and Lower Limestone series ; contain brachiopods, lamellibranchs, *Phillipsia* and corals.

Geol. Surv. 15 ; Ord. Pop. 79.



**Lamington.** In gully on hillside,  $\frac{1}{8}$  mile S.  $23^{\circ}$  E. of Hartside and in bed of burn, 1210 yds., 1310 yds. and 1320 yds. up from Hartside.  $1\frac{1}{2}$  miles S.W. of Lamington.

Ordovician, Caradoc, Glenkiln Shales ; contain graptolites and brachiopods. Geol. Surv. 23 ; Ord. Pop. 79.

**Lanark.** Lee Burn : (1) N.N.W. of The Lee ; (2)  $\frac{1}{4}$  mile E.N.E. of The Lee, right bank of burn, 100 yds. below main road ; (3) downstream from (2), left bank near water-level, between two little cascades. 3 miles N.W. of Lanark.

Carboniferous, Lower Limestone Series and Calciferous Sandstone Series ; contain brachiopods, lamellibranchs, gastropods and goniatites.

Hinxman, L. W. and others 1921, p.15.

Geol. Surv. 23 ; Ord. Pop. 73.

**Larkhall.** Stream nearly  $\frac{1}{4}$  mile S.W. of crossroads at Birkenshaw, a few yards downstream from remains of old mill. 2 miles S. of Larkhall.

Carboniferous, Upper Limestone Series (Orchard Limestone) ; contains brachiopods, gastropods, cephalopods, lamellibranchs, corals and trilobites.

Hinxman, L. W. and others 1921, pp. 63-64.

Geol. Surv. 23 ; Ord. Pop. 73.

**Larkhall.** Left bank of Avon Water, at bottom of Ringsdale Castle cliff ; also 260 yds. S.E. of site of castle and  $\frac{1}{8}$  mile W.S.W. of Birkenshaw. 2 miles S. of Larkhall.

Carboniferous, Coal Measures (sandstone under Slatyband Ironstone) ; "Millstone Grit" ; Upper Limestone Series (Gair Limestone) ; contain plants, crinoids, brachiopods and lamellibranchs.

Hinxman, L. W. and others 1921, pp. 76-77.

Geol. Surv. 23 ; Ord. Pop. 73.

**Lesmahagow.** In Teiglum Burn,  $\frac{1}{4}$  mile S.E. of and  $\frac{3}{16}$ th mile W. of Kerse.  $1\frac{1}{2}$  miles N. of Lesmahagow.

Carboniferous, Lower Limestone Series ; and Calciferous Sandstone Series ; contain brachiopods and lamellibranchs.

Hinxman, L. W. and others 1921, p. 17.

Geol. Surv. 23 ; Ord. Pop. 79.

**Lesmahagow.** Birkwood Burn below Kypehall Bridge,  $1\frac{1}{4}$  miles S. by E. of Blackwood station and  $1\frac{1}{2}$  miles N.N.W. of Lesmahagow.

Carboniferous, Lower Limestones ; contain lamellibranchs, productids and other brachiopods, corals, gastropods, cephalopods and bryozoa.

Hinxman, L. W. and others 1921, pp. 43-46.

Geol. Surv. 23 ; Ord. Pop. 79.

**Lesmahagow.** Nethan River ; right bank S. of Auchenheath House (first limestone N. of bridge at Burnfoot).  $2\frac{1}{4}$  miles N. of Lesmahagow.

Carboniferous, Lower Limestone Series ; contains brachiopods, corals and gastropods.

Hinxman, L. W. and others 1921, pp. 42-43.

Geol. Surv. 23 ; Ord. Pop. 79.

**Lesmahagow.** In bank of River Nethan, 266 yds. N. of Old Stockbriggs and 383 yds. N.  $12^{\circ}$  E., 466 yds. N.  $8^{\circ}$  E. and 468 yds. N.  $8^{\circ}$  E. of Old Stockbriggs.

Carboniferous, Lower Limestone Series ; and Calciferous Sandstone Series ; contain productids and corals.

Geol. Surv. 23 ; Ord. Pop. 79.

**Lesmahagow.** In bed of River Nethan, 200 yds. W.  $19^{\circ}$  N. of Auchlochan ; in bank of river, 115 yds. N. of, 500 yds. W.  $4^{\circ}$  S. of, and 500 yds. W.  $3^{\circ}$  S. of Auchlochan, Lesmahagow.



**Waterloo.** Garriongill, deep gorge of Garrion Burn,  $\frac{1}{2}$  mile S. of Waterloo and  $\frac{1}{3}$  mile N. of Law Junction : (1) top of scarp below Jacob's Ladder ; (2) a few yards above pumping station ; (3) left bank, 30-40 yds. below foot-bridge and miner's path.

Carboniferous, Coal Measures (from Kiltongue Musselband to Upper Ell Coal, *modiolaris* and lower *similis-pulchra* zones) ; yield non-marine lamelli-branches, notably from the Kiltongue Musselband ; basal fauna of *modiolaris* zone at two exposures at E. end of Section.

Macgregor, M. 1913, pp. 279-290 ; Weir, J. and Leitch, D. 1936, pp. 708-714.

Geol. Surv. 23 ; Ord. Pop. 73.

### MIDLOTHIAN

**Bonnyrigg.** Viewfield Sandstone Quarry, Bonnyrigg.

Carboniferous, Lower Coal Measures ; contains plants.

Peach, B. N. and others 1910a, pp. 377-387.

Geol. Surv. 32 ; Ord. Pop. 74.

**Borthwick.** Middleton Limestone Quarries ;  $6\frac{1}{2}$  miles S.S.E. of Dalkeith.

Carboniferous, Lower Limestone Series ; contains foraminifera, echino-derms, bryozoans and brachiopods.

Peach, B. N. and others 1910a, pp. 380-405.

Geol. Surv. 32 ; Ord. Pop. 74.

**Carlops.** North Esk, near second rivulet,  $\frac{1}{3}$  mile above North Esk reservoir and  $\frac{1}{2}$  mile S.W. of this.

Silurian, Wenlock Shales ; contain sponges, corals, brachiopods and lamellibranchs.

Peach, B. N. and Horne, J. 1899, pp. 593-597.

Geol. Surv. 32 ; Ord. Pop. 74.

**Carlops.** Wetherlaw Linn ; from scar on W. bank of Esk, a few yards N. of Wetherlaw Linn Burn.

Silurian, Wenlock Series ; contains sponges, graptolites, corals, trilobites, brachiopods and molluscs.

Peach, B. N. and Horne, J. 1899, pp. 597-598.

Geol. Surv. 32 ; Ord. Pop. 74.

**Colinton.** Water of Leith, left bank, above Spylaw House.

Carboniferous, Calciferous Sandstone Series ; contains plants, cephalopods and lamellibranchs.

Peach, B. N. and others 1910a, pp. 375-405.

Geol. Surv. 32 ; Ord. Pop. 74.

**Dalkeith.** Mayfield Quarry, 2 miles S.E. of Dalkeith.

Carboniferous, Lower Limestone Series ; contains crinoids, annelids, ostracods, brachiopods, lamellibranchs, gastropods and fish.

Peach, B. N. and others 1910a, pp. 383-405.

Geol. Surv. 32 ; Ord. Pop. 74.

**Dalkeith.** Cousland Quarries, 3 miles N.E. of Dalkeith.

Carboniferous, Lower Limestone Series (No. 2 Limestone) ; contains foraminifera, echinoderms, arthropods, bryozoans, brachiopods, lamellibranchs, gastropods, cephalopods and fish.

Peach, B. N. and others 1910a, pp. 383-405.

Geol. Surv. 32 ; Ord. Pop. 74.



**Dalkeith.** Left bank, River North Esk, 600 yds. W. of Elginhaugh Bridge, 1 mile W.S.W. of Dalkeith.

Carboniferous, Coal Measures (*communis* zone, black parrotly shales above Parrot Rough Coal) ; contain *Carbonicola pseudorobusta* ; fossils occur as red-stained flattened shells.

Weir, J. and Leitch, D. 1936, p. 732.

Geol. Surv. 32 ; Ord. Pop. 74.

**Edinburgh.** Craigleith Quarry, W. side of city of Edinburgh.

Carboniferous, Calciferous Sandstone Series (shales overlying sandstone) ; contain plants, annelids, lamellibranchs, gastropods, cephalopods, arthropods and fish.

Peach, B. N. and others 1910a, pp. 374-405.

Geol. Surv. 32 ; Ord. Pop. 74.

**Gilmerton.** Ferniehill Old Limestone Quarry, Gilmerton.

Carboniferous, Lower Limestone Series ; contains echinoderms, bryozoans, brachiopods, lamellibranchs and gastropods.

Peach, B. N. and others 1910a, pp. 376-405.

Geol. Surv. 32 ; Ord. Pop. 74.

**Gorebridge.** Blinkbonny Quarry ; 1 mile N.N.E. of Gorebridge.

Carboniferous, Lower Limestone Series (No. 3 Limestone) ; contains foraminifera, ostracods, bryozoans, brachiopods and molluscs.

Peach, B. N. and others 1910a, pp. 381-405.

Geol. Surv. 32 ; Ord. Pop. 74.

**Gorebridge.** Mansfield Quarry, 3 miles S.E. of Dalkeith.

Carboniferous, Lower Limestone Series ; contains brachiopods, lamellibranchs, cephalopods and gastropods.

Peach, B. N. and others 1910a, pp. 383-405.

Geol. Surv. 32 ; Ord. Pop. 74.

**Gorebridge.** Arniston Glen in steep slope on left bank 100-150 feet above stream (South Esk), 50 yds. upstream from wooden footbridge.  $\frac{1}{3}$  mile N.W. of Arniston Mains.

Carboniferous, "Millstone Grit" (lower part of "Millstone Grit" Marine Bed) ; contains brachiopods, lamellibranchs and crinoids.

Peach, B. N. and others 1910a, pp. 380-405.

Geol. Surv. 32 ; Ord. Pop. 74.

**Granton.** Wardie Shore between Trinity and E. side of Granton Harbour, Edinburgh.

Carboniferous, Calciferous Sandstone Series ; contains plants, fish, lamellibranchs and arthropods.

Peach, B. N. and others 1910a, pp. 374-405.

Geol. Surv. 32 ; Ord. Pop. 74.

**Heriot.** Corsehope,  $1\frac{1}{2}$  miles S. from Heriot station, W. side of valley of Gala Water, 250 yds. S. of Corsehope Burn.

Ordovician, Caradoc Series (Glenkiln shales and radiolarian cherts) ; the shales contain graptolites.

Peach, B. N. and Horne, J. 1899, p. 270.

Geol. Surv. 25 ; Ord. Pop. 74.

**Juniper Green.** Woodhall, Water of Leith, right bank at ford below weir near Juniper Green. 5 miles S.W. of Edinburgh.

Carboniferous, Calciferous Sandstone Series ; contains plants, molluscs, crustaceans and fish.

Peach, B. N. and others 1910a, pp. 375-405.

Geol. Surv. 32 ; Ord. Pop. 74.



**Loanhead.** Bilston Burn, left bank below Pathhead Farmhouse.

Carboniferous, Lower Limestone Series (shale in middle of the Bilston Burn Limestone) ; contains crinoids, brachiopods, lamellibranchs and gastropods.

Peach, B. N. and others 1910a, pp. 377-405.

Geol. Surv. 32 ; Ord. Pop. 74.

**Loanhead.** Bilston Burn, 1 mile S.W. of Loanhead, at Dryden.

Carboniferous, Lower Limestone Series (shale below Gilmerton Limestone) ; contains brachiopods and lamellibranchs.

Peach, B. N. and others 1910a, pp. 377-405.

Geol. Surv. 32 ; Ord. Pop. 74.

**Newtongrange.** D'Arcy Quarry,  $1\frac{3}{4}$  miles E. of Newton Grange and  $2\frac{1}{2}$  miles S.E. of Dalkeith.

Carboniferous, Lower Limestone Series ; contains foraminifera, ostracods, brachiopods, gastropods, cephalopods and fish.

Peach, B. N. and others 1910a, pp. 383-405.

Geol. Surv. 32 ; Ord. Pop. 74.

**Pathhead.** Currielee No. 2 Quarry, right bank, 20-30 ft. above River Tyne, 4 miles S.E. of Dalkeith.

Carboniferous, Lower Limestone Series (No. 2 Limestone) ; contains bryozoans, brachiopods, lamellibranchs, gastropods and fish.

Peach, B. N. and others 1910a, pp. 383-405.

Geol. Surv. 32 ; Ord. Pop. 74.

**Penicuik.** Fullarton Limestone Quarries,  $3\frac{1}{2}$  miles S.E. of Penicuik.

Carboniferous, Lower Limestone Series ; contains foraminifera, crinoids, ostracods, bryozoans and brachiopods.

Peach, B. N. and others 1910a, pp. 379-405.

Geol. Surv. 32 ; Ord. Pop. 74.

**Penicuik.** Mount Lothian Old Limestone Quarries, 3 miles S.E. of Penicuik.

Carboniferous, Lower Limestone Series (No. 2, Limestone) ; contains foraminifera, crinoids, ostracods, bryozoans and brachiopods.

Peach, B. N. and others, 1910a, pp. 379-405.

Geol. Surv. 32 ; Ord. Pop. 74.

**Penicuik.** Cornton Burn, right bank opposite Cornton ; 2 miles S.W. of Penicuik.

Carboniferous, Upper Limestone Series ; contains crinoids, brachiopods, lamellibranchs and gastropods.

Peach, B. N. and others, 1910a, pp. 379-405.

Geol. Surv. 32 ; Ord. Pop. 74.

**Polton.** Bilston Burn near Polton.

Carboniferous, "Millstone Grit" ; contains brachiopods, lamellibranchs and gastropods.

Peach, B. N. and others 1910a, pp. 377-405.

Geol. Surv. 32 ; Ord. Pop. 74.

**Stow.** Luggate Water,  $\frac{1}{2}$  mile upstream from confluence with Ewes Water,  $4\frac{3}{4}$  miles W.N.W. of Stow.

Silurian, Llandovery Series (Birkhill Shales) ; contain graptolites.

Peach, B. N. and Horne, J. 1899, p. 195.

Geol. Surv. 25 ; Ord. Pop. 74.

**Stow.** Ewes Water (Luggate Water) below Shepherd's house of Trously,  $4\frac{3}{4}$  miles W. by S. of Stow.

Silurian, Llandovery Series ; contains graptolites.

Peach, B. N. and Horne, J. 1899, p. 196.

Geol. Surv. 25 ; Ord. Pop. 80.



## PEEBLESSHIRE

**Baddinsgill.** Lyne Water, a few yards below Hareshaw Shepherd's house : 1 mile N. of Baddinsgill, near West Linton.

Silurian, Upper Ludlow Series ; contains trilobites, brachiopods and molluscs.

Peach, B. N. and Horne, J. 1899, pp. 601-602.

Geol. Surv. 24 ; Ord. Pop. 74.

**Broughton.** Glencotho Burn ; quarries near the burn, basin of Holms Water.  $4\frac{1}{2}$  miles S. by W. of Broughton.

Ordovician, Caradoc Series (Caradoc Limestone) ; contains crinoids, trilobites, brachiopods and molluscs.

Peach, B. N. and Horne, J. 1899, p. 258.

Geol. Surv. 24 ; Ord. Pop. 79.

**Broughton.** Quarries near Drummelzier, 2 miles S.E. of Broughton.

Ordovician, Caradoc Series (Caradoc Limestone) ; contains crinoids, trilobites and brachiopods.

Peach, B. N. and Horne, J. 1899, p. 257.

Geol. Surv. 24 ; Ord. Pop. 79-80.

**Carlops.** Old quarries E. of the village.

Carboniferous, Lower Limestone Series (limestone and overlying shales) ; fossils abundant in the shales including occasional crinoid cups and micro-crinoids and micro-fossils in general.

Peach, B. N. and others 1910a, pp. 379-405. Wright, J. 1932, p. 337.

Geol. Surv. 24 ; Ord. Pop. 74.

**Carlops.** South Mains ; old quarry, 300 yds. S.E. of South Mains, which is 1200 yds. S.S.E. by E. of Carlops.

Carboniferous, Lower (blaes below limestone) ; contain bryozoa, brachiopods, lamellibranchs and ostracods.

Geol. Surv. 24 ; Ord. Pop. 74.

**Culter.** Gair Gill (tributary of Culter Water,  $\frac{1}{2}$  mile S. of Snaip) ; at head of stream :  $3\frac{1}{2}$  miles S.S.W. of Biggar.

Ordovician, Caradoc Series (Glenkiln Black Shales) ; contain graptolites.

Peach, B. N. and Horne, J. 1899, p. 238.

Geol. Surv. 24 ; Ord. Pop. 79.

**Eddleston.** Cowie's Linn Burn (joins Eddleston Water  $2\frac{1}{2}$  miles N. of Eddleston station).

Ordovician, Caradoc Series (Glenkiln Shales) ; contain graptolites.

Peach, B. N. and Horne, J. 1899, pp. 252-253.

Geol. Surv. 24 ; Ord. Pop. 74.

**Eddleston.** Bowbeat Hill, near head of Leithen Water, 7 miles N.N.W. of Innerleithen.

Ordovician, Caradoc Series (Lower Hartfell black shales) ; contain graptolites.

Peach, B. N. and Horne, J. 1899, p. 264.

Geol. Surv. 24 ; Ord. Pop. 74.

**Eddleston.** In glen at Darn Hall, less than  $\frac{1}{2}$  mile W. of Eddleston station.

Ordovician, Caradoc Series (Lower Hartfell black shales) ; contain graptolites and brachiopods.

Peach, B. N. and Horne, J. 1899, p. 251.

Geol. Surv. 24 ; Ord. Pop. 74.

**Innerleithen.** Walker Burn, eastern branch, 200 yds. up, on slope of Glede Knowe ; 1 mile up from junction with the Tweed.

Silurian, Llandovery Series, Tarannon blue shales ; contain graptolites.

Peach, B. N. and Horne, J. 1899, p. 205.

Geol. Surv. 24 ; Ord. Pop. 80.



**Balintore.** Shore from  $\frac{1}{2}$  mile S. of Port-an-Righ (Cadhan Righ) to  $\frac{1}{2}$  mile N.E. of same.

Jurassic, Corallian, Oxford Clay, Kellaways Rock and Estuarine Series in descending sequence ; contain lamellibranchs, ammonites, belemnites and brachiopods.

Read, H. H. and others 1925, pp. 79, 81, 85, 99.

Geol. Surv. 94 ; Ord. Pop. 28.

**Cromarty.** Tidal foreshore,  $\frac{1}{4}$  to  $\frac{1}{2}$  mile E. of Cromarty.

Devonian, Middle Old Red Sandstone (Cromarty fish-bed) ; greyish mudstones with limestone nodules containing numerous fishes, e.g., acanthodians, placoderms and crossopterygians ; a locality made famous by Hugh Miller.

Miller, Hugh 1841, etc.

Geol. Surv. 94 ; Ord. Pop. 28.

**Ethie.** Ethie shore at low tide, 3 miles S. of Cromarty (a small exposure).

Jurassic, Kimmeridge Series ; contain lamellibranchs, ammonites, belemnites and plants.

Read, H. H. and others 1925, pp. 114-115.

Geol. Surv. 94 ; Ord. Pop. 28.

**Kinlochewe.** Meall a' Ghuibhais : streamlet rising near Loch ra Mna' Bige on N. side, 1 mile S. of Loch Maree and  $5\frac{3}{4}$  miles slightly N. of W. of Heights of Kinlochewe.

Cambrian, Fucoid Beds (*Olenellus* band) ; contains trilobites, especially *Olenellus*, and brachiopods.

Peach, B. N. and others 1907, p. 414.

Geol. Surv. 92 ; Ord. Pop. 26.

## ROXBURGHSHIRE

**Edgerston.** Jed Water at Doresford Camptown, 5 miles S.S.E. of Jedburgh.

Silurian, Wenlock Series ; shales containing graptolites and arthropods.

Peach, B. N. and Horne, J. 1899, p. 562.

Geol. Surv. 17 ; Ord. Pop. 86.

**Hownam.** Hindhope Burn, which drains N. slopes of Coquet Head, 10 miles S. of Morebattle.

Silurian, Wenlock Series ; shales with graptolites and cephalopods.

Peach, B. N. and Horne, J. 1899, pp. 562-563.

Geol. Surv. 18 ; Ord. Pop. 86.

**Langholm.** Archer Beck,  $4\frac{1}{2}$  miles S.E. of Langholm.

Carboniferous, Calciferous Sandstone Series ; contains brachiopods, lamellibranchs, corals, etc.

Peach, B. N. and Horne, J. 1903, pp. 847-848.

Geol. Surv. 11 ; Ord. Pop. 89.

**Larriston.** Larriston Burn, above its junction with Liddel, 5 or 6 miles N.E. of Newcastleton ; also from quarry,  $6\frac{1}{2}$  miles N.E. of Newcastleton.

Carboniferous, Calciferous Sandstone Series (Main Algal series) ; contain *Spirorbis*, *Ortonella*, brachiopods and ostracods.

Garwood, E. J. 1931, pp. 133-134, with map.

Geol. Surv. 11 ; Ord. Pop. 85.

**Newcastleton.** Liddel Water : in cliff opposite the manse about 2 miles above New Castleton.

Carboniferous, Calciferous Sandstone Series (Cementstone Group) ; contains worm-tubes (*Spirorbis*) and lamellibranchs (*Modiola*, etc.).

Peach, B. N. and Horne, J. 1903, pp. 841-842.

Geol. Surv. 11 ; Ord. Pop. 85.



**Newcastleton.** Kershope Burn, from a little below Kershope to near head of burn ; 3 miles S.E. of Newcastleton.

Carboniferous, Upper Calciferous Series (Lawston Linn Series) ; contains brachiopods, molluscs and plant remains.

Garwood, E. J. 1931, pp. 129-131 with map.

Geol. Surv. 11 ; Ord. Pop. 85.

**Newcastleton.** Upper part of Tweeden Burn, Liddel Water ; 1 mile S.E. of Newcastleton.

Carboniferous, Calciferous Sandstone Series ; contains brachiopods, molluscs and fish remains.

Peach, B. N. and Horne, J. 1903, pp. 848-849.

Geol. Surv. 11 ; Ord. Pop. 85.

**Newcastleton.** Harden Burn above Dikeraw, 3 miles N.E. of Newcastleton.

Carboniferous, Calciferous Sandstone Series (main algal series) ; contains lamellibranchs, ostracods and plant remains.

Garwood, E. J. 1931, pp. 129-131, with map.

Geol. Surv. 11 ; Ord. Pop. 85.

**Newcastleton.** Lawston Linns, Liddel Water ; 4 miles S.S.W. of Newcastleton.

Carboniferous, Calciferous Sandstone Series ; limestone and nodules in soft shales containing corals, brachiopods and lamellibranchs.

Peach, B. N. and Horne, J. 1903, pp. 847-848.

Geol. Surv. 11 ; Ord. Pop. 89.

**Penton.** Limestones and shales in bed and banks of the Liddel Water, below Penton Bridge.

Carboniferous, Lower Limestone Series ; fossils abundant, including a layer of crinoid crowns in shale overlying main limestone.

Peach, B. N. and Horne, J. 1903, p. 850 ; Wright, J. 1924.

Geol. Surv. 11 ; Ord. Pop. 89.

**Priesthaugh.** Priesthaugh Burn (joins Allan Water below Skelfhill), about 8½ miles S.S.W. of Hawick.

Silurian, Wenlock Shale Series ; contains graptolites, crustaceans, cephalopods and brachiopods.

Peach, B. N. and Horne, J. 1899, p. 560.

Geol. Surv. 17 ; Ord. Pop. 85.

**Riccarton.** Riccarton Junction ; from burn at the junction.

Silurian, Wenlock Shale Series ; contains graptolites and cephalopods.

Peach, B. N. and Horne, J. 1899, p. 561.

Geol. Surv. 17 ; Ord. Pop. 85.

**Riccarton.** Peel Burn, above Myredykes, about 4 miles slightly N. of E. of Riccarton Junction railway station.

Carboniferous, Calciferous Sandstone Series (Cementstone Group) ; contains lamellibranchs, brachiopods, fish, plants and algae.

Geol. Surv. 17 ; Ord. Pop. 86.

**Riccarton.** Thorlieshope Burn and old quarry, 8 miles N.E. of Newcastleton.

Carboniferous, Calciferous Sandstone Series (Cementstone Group) ; contains corals, echinoderms, ostracods, brachiopods, lamellibranchs and gastropods.

Peach, B. N. and Horne, J. 1903, pp. 842-843.

Geol. Surv. 11 ; Ord. Pop. 86.



**Kilsyth.** Corrie Burn, W.N.W. of Cairnbog Farm,  $2\frac{1}{4}$  miles W.N.W. of Kilsyth ; also 2 miles W.N.W. of Kilsyth.

Carboniferous, Lower Limestone Series ; contains plants, lamellibranchs, brachiopods and gastropods.

Robertson, T. and Haldane, D. 1937, fig 4, p. 17. Hill, D. 1937-1941, p. 23.

Geol. Surv. 31 ; Ord. Pop. 66.

**Larbert.** Torwood Glen : right bank of burn, 20 yds. and 50 yds. upstream from road bridge ; at point about  $\frac{1}{2}$  mile W. of Carbrook House ; at point where Roman Road crosses the stream, bed on right striking up and down stream :  $2\frac{1}{2}$  miles N.W. of Larbert.

Carboniferous, Millstone Grit Series ; contains brachiopods, gastropods and lamellibranchs.

Hinxman, L. W. and others, 1917, p. 38.

Geol. Surv. 31 ; Ord. Pop. 67.

**Lennoxtown.** Lower Glenwhapple, N.W. of ruins of Craigenglen Cottage, 300 yds. S.S.E. of Upper Carlstoun Steading,  $1\frac{1}{2}$  miles S.S.W. of Lennoxtown Church.

Carboniferous, Calciferous Sandstone Series (Craigenglen Beds, type-locality) ; contain gastropods, productids, lamellibranchs, cephalopods, bryozoans and ostracods.

Clough, C. T. and others 1925, p. 26.

Geol. Surv. 31 ; Ord. Pop. 66.

**Lennoxtown.** Burn a little below Bencloich Mill,  $\frac{1}{4}$  mile N.E. of Lennoxtown.

Carboniferous Limestone ; soft grey shales containing brachiopods, lamellibranchs, cephalopods and gastropods.

Robertson, T. and Haldane, D. 1937, p. 14-15.

Geol. Surv. 31 ; Ord. Pop. 66.

**Lennoxtown.** Burn Rannie at Balgrochan,  $\frac{1}{2}$  mile N. of Lennoxtown.

Carboniferous Limestone ; dark shale below Main Limestone yields gastropods, brachiopods and lamellibranchs.

Robertson, T. and Haldane, D. 1937, p. 14. Clough, C. T. and others 1925, p. 41.

Geol. Surv. 31 ; Ord. Pop. 66.

**Lennoxtown.** Glenwynd,  $1\frac{1}{2}$  miles S.W. of Lennoxtown.

Carboniferous, Lower Limestone Series (blaes between Hurlet Limestone and Coal) ; contain cephalopods, lamellibranchs, brachiopods and crinoids.

Clough, C. T. and others 1925, p. 41.

Geol. Surv. 30 ; Ord. Pop. 66.

**Lennoxtown.** Old quarries near Glorat, 1 mile N.N.E. of Lennoxtown.

Carboniferous Limestone (limy shale resting on Main Limestone) ; contains trilobites, brachiopods, lamellibranchs, gastropods and cephalopods.

Robertson, T. and Haldane, D. 1937, p. 24.

Geol. Surv. 31 ; Ord. Pop. 66.

**Linlithgow.** Left bank of River Avon opposite Littlemill,  $1\frac{1}{2}$  miles N.W. of Linlithgow.

Carboniferous, Upper Limestone Series (Dykeneuk Limestone) ; contains productids, bryozoa, lamellibranchs, trilobites and gastropods.

Macgregor, M. and Haldane, D. 1933, p. 62.

Geol. Surv. 31 ; Ord. Pop. 67.

**Milton of Campsie,**  $\frac{1}{8}$  and  $\frac{1}{8}$  of a mile E. of Shields Farmhouse and 1 mile N.E. of Milton of Campsie.

Air Photo  
(1952? ±)

GSTJ 1-178

(Harlan, S.W. 15' Quad)

Now called Wallins Creek  
Quad.



Sept 12, 1967

9/12/5 Molas loc.

where Riv. bends to rd.  
N. side 0.55 mi W of Co. Line  
by rd.

Mileage out

35330

7/7/67

British Museum

I. 1784 Purch. J. W. Kirkby Oct. 1888

"  
Ler.  
Beurichia cratigera  
Calcareous sst. series  
Back Burn, Plaster, Northumberland  
1 of valves, 2 corapaces, one crushed,  
best specimen white, faint large  
reticulations



faint ridge

Not type

I 57 Purch J. A. Armstrong 1880

Beurichia fastigiate I & k

Cost ls Ser., Crossgatehall near  
Edinburgh

6 corapaces sub int. molds  
one or 2 show Beurichiopsis ridge

females have a postnuchal sulcus



may be reason  
for trilobate

Not Types





3

*Cypris arcuata* Bean  
lectotyp. IN 43596  
by Pollard -

drawings A & B wrong  
no bulge on post. valve  
is a ridge on post. valve  
see fig. C & D. shape, A & B  
wrong. No post spine

---

I 15554 *Cypridina bosqueti*  
C L Middleton Co. Cork / Carbonif. Ls.  
L. Carb. good muscle scars &  
notch on stamens.

---

I 758 *Cypridina elongata* J & K

Mon. Pal Soc. 1874 p 81, pl. 6  
fig. a.c. shows microconcretions

---

*Entomis biconcentricus* - sulcus  
is artificial

---

*Kirkbya annectens* = *Bepridnopsis*?



7/8/67

Hancock Museum  
Newcastle on Tyne  
Mr. A. Tynan Curator

---

Lower Lias, Deyford, Worcestershire  
~~and Barton~~ Polycopel Flavan  
slide with many specimens  
in Tray 28

7/8/67-1 Beach south of St. Mary's  
Lighthouse N of Whetly Bay

7/4/67-2 ~~Stought~~ - near Pub - Seaton Sluice  
(old loc. Brandy, Norman probably Brandy  
stream - tide marks in  
to form brackish environment  
(Seaton) De la Bel family 18th century  
attempted a harbor here.  
now home of Lord Hastings.  
Northumberland coal basin

7/9/67

Brady's 1oz. of salinus in  
cooling pond (double bag) and  
lily pond (single bag)  
Wear mouth (all in) both in  
1 bag

2 Photos of Church

1 Photo of bus

2 Photo of Jurassic  $\rightarrow$  N  $\rightarrow$  S  
Pointed hill to E.

7/9/67 Canal, road, bag (live)

mona sea.  
Not a sea  
Candace  
Cypripedium



Howe

7/19/67

Homonymy - rename problem  
because of available name.

subsequent secondary homonymy

\* Benth's alternate Brady  
not Gilly.

— 1/2 million embryos —

varietal names not recognized  
in Rules.

Benson

— parallel C

have you grown the mistars.

Markings.

6-0 spin

.94

4 SV

1.41

♂ 6-10 4 spines

no can L

1.3-1.33

♂

♂

enlarge you have grown

1.66

♂

4 spines

100% 100% diff

Typical  
uniparous  
1st diff. size.

Geigy Industrial Chemicals  
Division of Geigy Chemical Corporation  
Ardsley, New York 10502  
Quaternary O.

---



Quaternary - 0 - to beach sample  
settling water of Calsol  
(N.I. company) 7/12/67

Spectroscopic analysis  
shore, N. Sea - near shore  
G. P. ... Nucle location

7/12/1 Kimmeridgean - Calceolophanes  
in beach pit 1 black clay

7/12/2 Middle B - cement beds  
pit correlation - Near  
Black shale with large in-correlation  
S. of pit box

7/12/3 Lower B - Just S of stone  
setty 1 to shore, pit of  
wood near lot.

7/12/4 either lower B or u.c.  
no pit, 50'  $\pm$  S of "setty"  
"7" thin slip block ... ?

7/12/5 C-6 between 2 setts

7/12/6 C-7 about 10-15' above, but  
45'  $\pm$  to the North  
Pit of group at C-8 & 7

7/12/7 ~~D-1 at base~~ C-11, plastic  
black clay 4'  $\pm$  above base

7/12/8 D-2

7/12/9 D-3

Youngs Knob.

Photo to frame 9 in L. Cret.

Bate leador

7/12/67 p. 2

7/12/10

Gray ls. series (scabos. beds)

*Antoridectavata percyi*

*cytonens Forbesella*

Prof. Howe collecting 7/12/10

7/12/11

Bed 5 Bate 1967 p. 19

Sec. #7

7/12/12

Bed p. 18 bed 12 Sec. 7

prof. Earthly sitting facing camera

excavate digging

7/12/13

Bed 13

fig. seascape with group  
on bed.



Robinson  
McKay

7/15/67

7/15/1/67 Reef ls with ostracodes + brachiopods  
loc. 13 of Geoffrey Bond, 1950  
Q JBL vol 55, p. 184, Butter Hill, quarry, small  
Pict of Robinson and McKay in Quarry  
Pict of OKT 1/2 Throbarrow Quarry  
Photo of Trout Barrow Quarry - or J&K  
Starr Moss.

7/15/2/67 SD 481/757

on rd. a well preserved part  
plant to abandoned tram.  
collected S of old rd  
3 bags of sh. 1 of clay or  
calcareous shale to explore  
J&K Starr Moss loc.  
pict from RR tracks &  
2 of loc. with J. McKay finger  
and coll. spot.  
#27 Top side of ls. with  
Giantoproductus

#29, 30 Morecombe Bay  
McKay to St. across 2.

Pict of  
McKay  
on left

7/15/67  
Slept in Arnside in an 1900's

hotel with magnificent  
grounds including putting  
green, 15 holes with Robins  
and McKay - made 2 holes  
in 2 shots.

Breakfast at 9 so we  
are up & going to collect  
before breakfast on shore  
of Morecombe Bay J & K  
type loc. close to Beachburg



Arnside section

7/10/67

7/16/1

Shale between ls ledges

7/16/2

shale slightly above

7/16/3

shale above just under  
ls. bed lots ls of above.

Pict. 7 loc.

detail pict with red trout

7 7/16/2

7/16/4

Megafoss 300' down beach  
character + One bag labelled  
7/16 with Mitchell Lane.

---

Farm. Thorlieshope Burn <sup>Marine</sup>  
Limestone quarry (575E 963N)  
572E 964N Sheet NY 69

7/16/5

Lower sh. below ls "Non Marine"  
Pict. across creek

7/16/6

Sh. (more marine) above water fall  
above ls. (Vaughania, Atrypa).

7/16/7

1"± at base of above

7/16/8

Channel above 7/16/6  
Last pict of Eric at loc.

7/10/12 - 13

Hill, 1938 p. 24

Harlow; Longmiddy, East Lothian.  
Thin beds, limestone 3 ft. above  
basement Limestone. Longmiddy Limestone.  
Calcareous Sandstone Series, Zone 3  
Laminia juddi.

" p. 28 shows this to be below Lower Limestone Group



7/16/67 P.2

7/16/9 Starishiel Burn  
Tourmasian cementstone  
below Algal Reef. (Marine)  
Bayrichopsis

18" shale between Ls in  
2<sup>nd</sup> waterfall from Rd.  
up stream

7/16/10 Up stream alternating  
Ls. fire clay Ls. sh. 8"

✓ 7/16/11 about 5' below 7/16/10  
more silty with gastropods

7/16/12 Quarry Hareland Hill Quarry  
Hill "Sect. 4th. Corals" p.24?

7/16/13 2' ± high  
both above Ls  
Pleasant Sec. 1938-39  
Nash 1956 Geol. Soc. G. F. Ford, Trans  
Vislan P2

Geol. Survey Mem. Scotland  
Econ. Geol. Ayrshire Coalfields Area<sup>III</sup>, 1930

7/17/67

~~Ken~~ Garpal Water, Muirkirk  
Carluke area no longer available  
Calmy Ls. (Known as Gare  
or Gair)

7/17/67-1

Calmy Ls. shale above  
1' ± interval directly  
above shale, S. of bridge  
which is second bridge  
from Rd. out of Muirkirk

7/17/2

shale ± 1' above 7/17/1

any ostracodes here  
should be approx. the  
same spp. described by J&K  
it is impossible to determine  
their localities

Photo 1 - John in Tree with spec. in  
loc. of coll. 1 & 2.

Photo 2 - distant shot of bridge  
and above loc. at it - tree same as above

(colder than above)

7/17/3

sh. below unnamed this  
Ls - equivalent to Orchard Ls  
of the standard Glasgow Basin  
succession on W side of Creek  
S. of previous coll. 16 ft from Ls

7/17/4

sh. at base of this unit 7' ± with  
Tribolites etc. Do not wash



7/17/67 p. 2

7/17/5  
✓

Shale slightly lower (older) than above. 25'± same # as 7/17/3

7/17/6

Sh. 5'± lower than above. somewhat harder.

Walk up stream past coal. to Marine sh. and Ls. which is ~~not~~ Hosie's known here as McDonald Ls. or Lss. if interbedded foss. shales. ∴ can't be sure of I&K exact loc. which are called by I&K Lower Lss. here.

7/17/7

Sh. below Ls. thin 1'±, muddy Ls. ~~barryde~~ below Thickest Ls 3'± shale chips vertically for 3'± W side of stream (McDonald)

7/17/8

100'± upstream E side of stream shale slightly lower below a Thinner Ls. with iron nodules above Ls. Sh. 3'±

It rained all day. Went to Hamilton for next few days Angus Hotel.

6 hoses but only 4 exposed  
at Brockley.



7/17/67 p.3

Brockley name of Farrer  
could include fossils from McDonalds  
stream Poniel Water cut in stream is loc.  
Walk upstream from farm (ruin)  
cross fence to loc.

✓ 7/17/9 Shale compound 5'±  
horn coral

✓ 7/17/10 Lower in sec. above 5'±6"  
coal seam down stream  
and around corner up  
Tributary to rt. creek  
from farm.

Above 2 Lower Ls group  
older than previous coll.

7/18/67

Glen Whapple = Craigen Glen  
(Craigen Glen no longer on maps)

see. on p 23 of Glasgow District 1925

~~7/18/1~~

Walked up creek but  
could not find outcrops

✓  
7/18/1

Glen Wynd Burn

(G on Map)

Craigen Glen shale

Hollybush Ls just below

Hollybush Ls

✓  
7/18/2

Upstream at waterfall

Ls. making fall

Balderhock Ls. (Entomostracan

Ls. or White Ls)

2 of 2 18"± above Ls. same unit

~~7/18/3~~



7/18/67 p. 2

✓ 7/18/3  
"C" on map

The Coral Limestone  
Corrie Burns Campsie  
Top of Upper sedimentary  
group of calciferous ss.  
shale 7'± below Ls.

✓ 7/18/4

clay-sh. just below Ls.  
some between Ls.  
photos 3-4 (after one of me) canyons  
we collected, white spots sheep

7/18/5

Hurlet Ls. shale bot. Ls. beds  
2 pits on Hurlet # ~~goats~~  
sheep.

#16 of 7/20

{ pict. Modern Town shopping hotel,  
entertainment unit  
Cumbernauld - new town  
Levenshire cemetery

Pict. of Richard Owen cotton  
mill who built substantial  
houses - son - New Harmony  
chimney pots for Benson  
New Lanarkshire.

7/19/67

pict.

Hamilton Museum Dukes & Ham.  
Amberador & Naples painted  
eruptions & Vesuvius became  
Volcanist & Volcanologist -  
Hamilton Teachers College New bldg

Calderwood Glen, East Kilbride Scotland  
Scott. G.S. Mem. Econ Geol & Central Coalfield  
Area 8, 1917.

7/19/1  
✓  
Top of Calceiferous ss. 24' below  
Main Ls. Gray crystalline Ls.  
Central Coalfield Area 8 part  
check for corrodonts

7/19/2  
Top of Main Ls. 2' just above  
plastic bag.

✓  
7/19/3  
(Don't read)  
Entomostrean Ls. below Hasic  
above Black Hall (wee) Ls.  
up stream past waterfall

7/19/4  
Shale in HASIC Ls. & Eric has section  
2 of 2 to 2' ± higher (1st Ls. 4 to 6')  
pict. Kiopark & hammer, top of handle  
first sample, cyl above light patch  
second sample

pg  
in 2000 ref.



Walk up stream

7/19/67 p. 2

7/19/5  
✓

Shale with Chonetes rugosa  
Just above Hurlet ls.

name of creek  
✓ Calderwood Glen

7/19/6  
✓

Sh. below Calderwood cement  
ls.

2 pict. cows & New Town & draw  
population from Glasgow. Industry encouraged  
by tax favor.

7/19/7

"L" on map

Quarry SW of Glasgow  
Lyon Shields Quarry  
Shale in Broadstone ls.  
above mined ls. & ~~top~~ below  
the Hurlet or near top of  
Calcareous ss.

Docta Quarry

7/19/8

"D" on map

Shale in middle  
2 bags above mined ls.

7/19/9

Shale near Top below ls. layer

7/19/10

"T" on map

Docta Trearne Quarry  
Shale from ls. block in working quarry

7/20/67

Got up with pain above and  
slightly behind right ear.  
felt dizzy all morning off and on.

Afternoon felt better. Took  
picture of center in New Town  
see 7/18 - Drove East to

Lilienthgow took 2 samples in  
River then to quarry for 2  
bags. Pic of Palace also of  
Bridge & clouds



See sheet  
#7

7/20

AM Univ. Glasgow

Ken Shields - Carb. brach.

J.D. Lawson - Ludlow Research Group

P.M. Bridge on Avon River

Linlithgow ← Palace where Mary Queen of Scots  
was born.

7/20/1

Shale above (main post 7)

Index Ls. 3' ± above

2 bags

7/20/2

Shale below Index Ls.

✓ Water was high so we  
collected with shovel from under  
1' + of water in both localities

Pict. VW 10 & Palace in distance

7/20/3

Whiteboulds Quarry

(mudstone) shale above Whiteboulds

Ls.

2 bags

*Beprichia variegata*

*Beprichella reticulosa*

There are marine intercalations in  
volcanics.





7/21/67

Pict. of Palace, Church &  
oil shale spoil heaps - no longer  
used but reserves present.  
Abden sec. N. side of Firth of Forth, Kirkcaldy & Kirkcaldy  
Pict. 2<sup>nd</sup> Abden dipping S.  
call 344

7/21/1

1<sup>st</sup> Abden ls. intercalated  
in lavas.  
shale ~~below~~ 6" between  
ls.

7/21/2

shell bed below 1<sup>st</sup>  
Abden ls. with Rhipidomella  
8' to 10' below base of 1<sup>st</sup>  
Abden ls.  
photo bag ~~on~~ 7/21/2; shown on 7/21/2  
photo 2<sup>nd</sup> Abden, lavas on left

7/21/3

sh. <sup>near</sup> ~~at~~ base of 2<sup>nd</sup> Abden

7/21/4

sh. 2' higher in same bed, shell  
bed just below ls.  
pict. Eric back call 344, 3 at knee  
level 4 at shoulder ±

7/21/67 p.2  
Walk east along ~~road~~ past  
drain pipe to see Seafield Tower &  
Ls. outcropping - Seafield Tower  
Ls. dipping into sea  
Pict. of Tower & Ls. dipping  
Seafield Tower Ls. - Charleston  
Main Ls.

7/21/5 should 2' below Seafield Tower  
Ls.

Hosie ss.

7/21/6 sh. approx. middle or 3<sup>rd</sup> Ls.  
Taken just below Ls. below  
Seafield Tower

Pict. Eric in front of Ls which  
is thrust on itself toward shore  
Hosie sequence. Kirkcaldy in  
background Sample just below  
this Ls.

Picture of Tower same as top of page  
3 hrs later - Tide in

7/21/7  
Sheet 7  
✓  
Gosford Bay - East Latham  
Post glacial raised beach  
about 4' which is 8' to 10' above  
high Tide level. Note bay with  
recent shells for comparison



7/22/67

last pit roll 3 (North  
Bass Rock near Berwick-  
on-T.

Volcanic plug. Basaltic  
start roll 4.

7/22/1

Link between

Calcareous series & have in  
Scaevastrom Coal Group of  
Northumbria land, this is  
extensive: seltic series  
not much ls.; thin coal.

Cove Harbor, 2 marine  
ls. called L & U Cove  
marine bands. Mostly thick  
ss.

Roll 4.

Pit 1 Cove Harbor note wave cut  
terrace on it.

Pit Cove Harbor ss 100' or so by  
bowling club. Hole in tunnel  
in ss to reach harbor, dark water  
in front of L. Cove ls.

The shales are micaceous,  
sandy - occasional plant

7/22/1

✓

L. Cove ls. for etching inside  
of harbor. J. Pringle Map in

South of Scotland Handbook, G.S.

2 pits worm casting Nereis not  
divesicula

See Fowler, A. 1966  
G S Great Britain Bull 24, p. 57

---





7/22/93

Siccar Point - Hutton  
unconformity

Siltstone on/and Old Red  
flat - picture - sil  
upright & old Red ss flat



Northernumberland

Berwick upon Tweed 7/23/67

succession Between Bretherton  
Point & H. Hall, (N of fort) ~~below~~ <sup>below</sup> swimming pool

7/23/1

Shale above Oxford Ls. above  
batting pool in Fishermans  
Harbour Berwick Shale =  
lowest cal. Sh. of Middle Ls  
Gr. of Northernumberland =  
Huddle T Ls of Meland Valley  
near top of "P. id"

7/23/2

Shale within Oxford 100' ±  
S. of 7/23/1 at shore level  
above High Tide

7/23/3

First marine horizon below  
Oxford. shale above 4' ± Ls  
about 15 feet lower





7/23/67 p. 2

Serengeti  
Sand dune shore  
Cheswick

7/23/4

Shale above sand bank  
4 Fathom ls. with magnesian  
weathered material  
≠ Quartz

7/23/5

Some shale unweathered

7/23/6

shell bed in shale just  
above

Pit ENE bearing 7/23/5-6  
hit weathered slope 7/23/9



①

②

sand dune

ls

7/23/7

Shale below ls. post

Lime Works

Cheswick, Quarry 5.7 miles 7/23/8

7/23/8 Shale on top of  
fossiliferous ls.

Go through Scrematoron  
To Acre Limestone Quarry  
at Bowdler, 3 miles N. of  
Lowick

7/23/9 Clay above Acre ls.

Great ls. faintly beginning  
of Namurian

7/23/10 shale above Great ls.  
Graptolites etc.

Dryburn Quarry, Dryburn ls.  
Shale above.

7/23/11 Shale part in 5" thick  
bet. <sup>12'±</sup> ls. about 11' lower  
argillaceous, about 1'6" above  
top of Dryburn ls.

Pit

Feace  
x 7/23/10  
7/23/11

Mc

0.5

Pit. Bamburgh Castle, Bishopscourt



7/23/67 p. 4

7-23-12

Snoek Point sea house  
shale above Eelwell Ls.  
bed below Eika.  
older than prev. coll.  
Photo shell bed from which coll.  
was made close up with pen.

Star Hotel  
Warkworth, Northumberland  
pic. Miniskirt & Warkworth  
Castle

7/24/1967  
Pict Warhwith bridge &  
castle.

Lunch with Westall in  
Newcastle



Leeds

p. 1  
7/25/67

Van der Heide, 1951, Les.  
Arthropodes du Terrain.  
Horviller du Limbourg Meridional  
Meded. Geol. Stichting  
Ser. C IV-3-no. 5

specimen of

Cypridina phillipsi Jones of

Corsin in Leeds RG 232  
Coal Measures, Shilling Hill  
Bore Hole one mile S of  
Ferrybridge Station, Yorkshire  
at 515' 6" from Mansfield  
Marine Band,  
has a structure resembling  
the developed in the  
laboratory on recent myodocoid  
specimens

Leeds

7/25/1

SY 417 cf. "Cypridina phillipsi Corsin"  
on slab with Coelocautulus >P  
and Lingula sp.

Coal Measures Mansfield Marine  
Band: Cinderhill Colliery No. 9  
Shaft Notts, 106 ft. from surface  
coll. survey 1945  
chips with spec.



marine band

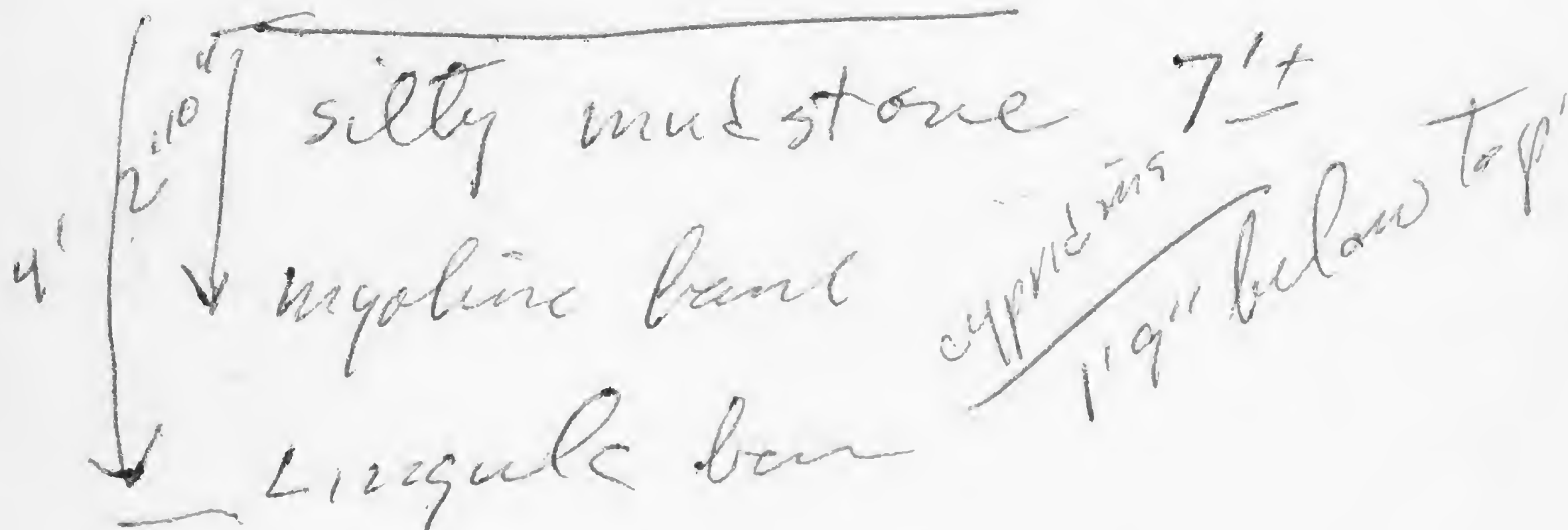
Cut in incomplete heading to  
Strengthen U.S. Route 119

$\frac{3}{4}$  m. N of Cardinal # 600 yd  
NW of Bench Mark 1099,  
between Stillhome & Minton  
Branches. E margin of Bell Co.

8 ft Exp.

Blue shaly mudstone

Top 3"-4"





P. 2

7/26/67  
Cypress inflata Murchison  
or Passap. inflata V & B.  
or Lepid. inflata Jones  
is probably Carbonite

---

Ky loc. from Eggs  
Hance fm. along Route US 119  
in vicinity of the border  
between Harland and Bell  
Cos. SE Co.

North of Molar - by Waulser  
west bank of road 330 yd  
N 10° W

Wallins Creek Quad.  
just S. of Cumberland?

---

Balkan Quad.

see  
above

rd cutting w of Stillhouse  
branch

7/26/67

Nobend Brick Work  
Farnsworth Manchester  
Now a dump - stinks

7/26/1

"*Cythereella foveolata*" band  
in upper *Similis pulchra*  
zone 50'± above  
Dukinfield Marine Band =  
Lower part Westphalian "C".

3'6" shale

SS

→ sample 3 and slide B & follow it.

2'± DK gray shaly mudstone

1' Black carbon shale  
SS.

*Nadites carbonita humilis*

[Expt 7 sheet 85

CW Wright 1931. Geol.

Manchester District: Mem.

Geol Surv. Gr. Brit.

fig. 35 p. 108.

loc. "C" on fig. 36



British Museum

7/27/67

I 6057 Cypripedium raisiniae Jones

Ord. Cliff of Cove W of  
Pared/Helchymenyn  
Llyn, ~~Gwynedd~~

Cacrhavonshire.

Q JGS 1853 p. 16 woodcut

Not an ostracode  
also Eric Robinson saw

---

check Ektyplocythere  
Bates — for L. Cret.

Cypripedium  
radiata  
spec

Charles Waterston  
Royal Scottish Museum  
Chambers St.  
Edinburgh 1 - South

7/27/67 p. 2

Dr. Anderson has spec.

Cypripedium of radiate GSHH 1351

Coal Measures Roof of Coleford  
High Delf Coal

Tip (spoil) of Arthur  
Edward Colliery (Waterloo pit),  
 $\frac{1}{2}$  mi. W 28° S of Brerley, ~~Glou~~  
(Map) → Gloucester 1" 233

A specimen 6 mm long  
is an internal mold  
of a part of a Myodocoid  
showing (muscle scar(?))

No radiate structures

referred to GSGr. Br. Geology of  
the Forest of Dean  
Coal and Iron-ore field  
by FM Trotter 1942 Report  
1964.



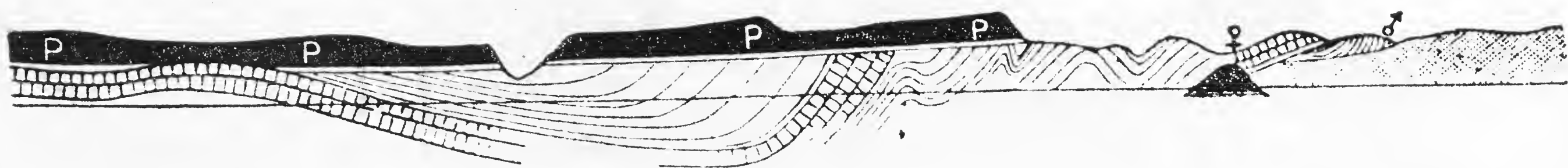


Fig. 99. Section along the western escarpment of the Krokskogen lava plateau. The lavas (P) with their basal Permian sedimentary rocks overlie the folded Cambro-Silurian series. The Drammen granite to the south (right).  
(After Th. Kjerulf 1865.)

p. 7—24), and he has later presented a comprehensive description of the Permian rock complexes and structures of the Oslo graben (Holtedahl 1953, p. 486—556, in Norwegian).

Together with J. Schetelig, Brøgger edited a number of geologic maps in scale 1:100 000, covering nearly the whole region.

Unfortunately these maps were never distributed through the regular channels, because they were never given descriptions. A survey map in scale 1:250 000 was printed in 1923 and was issued 10 years later (Brøgger 1933 a). A map of the surroundings of Oslo (1:50 000) accompanies the "Guide" by Holtedahl and Dons (1957).

The Oslo region contains irregular areas of Cambro-Silurian sedimentary rocks (Fig. 40), and sedimentary, volcanic, and plutonic rocks of Permian age, see Plate 13. The areal distribution of the more important Permian igneous rocks appears from Table 1. The following description is an attempt to present the most important data from a comprehensive literature. The rocks are grouped in volcanic, plutonic, and dike rocks, and the chapter is concluded with comments on magma formation, faulting, etc.

### **Permian basal sedimentary rocks.**

The Permian supracrustal rocks of the Oslo region consist of a thin series of sedimentary rocks, conformably overlain by a thick series of volcanic rocks. Both of these series have been faulted, but not folded. The sedimentary rocks are lying on a sub-Permian peneplain, cutting various strata of the underlying series of Cambro-Silurian rocks which in the northern half of the Oslo region are folded (Fig. 99) while south of Drammen the folding dies out.

The age of the post-Silurian rocks was not known until 1931 when Holtedahl discovered fossils in the sedimentary series and these fossils were determined to lower Permian age. Fossiliferous strata occur also

Table 1.

*Principal igneous rock types of the Oslo region and their areal distribution (from Barth, 1945, p. 17, with some changes).*

Magma group	Plutonic rocks		Extrusive rocks	
		km <sup>2</sup>		km <sup>2</sup>
Gabbroic	«Oslo-essexite» (Gabbros, kauaiite, bojite)	15	Basalt and trachy-basalt	220
Monzonitic	Kjelsås site	201	Rhomb porphyries	1160
	Larvikite, etc.	1705	Tuff	25
	?		Trachyte, rhyolite, welded tuff, explosion vents	55
Nepheline monzonitic to syenitic	Lardalite to Foyaite	65		
Syenitic	Alkali syenite, Nordmarkite	1400		
Granitic	Ekerite	821		
	Biotite granite	840		
	Sum km <sup>2</sup>	5047		1460

between the lowermost lava flows at Holmestrand, indicating that also the volcanic activity is of Permian age.

The sedimentary rocks show considerable local variation. They consist of red and grey sandstones, red shales and a quartz conglomerate. This conglomerate is a very characteristic formation within the series. Pyroclastic deposits and sandy tuffitic beds occur in the upper part of the series. The most important section is that of Semsvik, Asker, where the fossils were found, some 19 km WSW of Oslo. The following beds occur, from below: red, sandy shale (not exposed in solid rock); conglomerate with 1—3 cm pebbles of quartz and quartzite (visible thickness 8 m); easily weathered, greenish-grey shale, with sandy layers, fossiliferous (5 m); grey sandstone overlain by red sandy beds, intercalated with conglomeratic beds (10 m). The pebbles of the conglomeratic beds consist of basaltic lavas. Then follows the first basalt lava.

The fossils are plants (Høeg, 1935, 1937 a, b), fresh water molluscs (Dix and Trueman 1935) and fishes (Heintz 1934). The plant fossils belong to the following genera: *Calamites*, *Lebachia*, *Walchia*, *Cordaite*, *Neuropteris*, and *Callipteris*, the molluscs to *Palæanodonta*.



The fishes are represented by remains of a fresh water shark, *Pleuracanthus*, and of *Megalichtus* and *Amplipterus*. Some fossils indicate clearly a lower Permian age, probably the middle part of lower Permian, while others are related to Carboniferous forms.

Thus the fossils as well as the character of the sedimentary rocks point to a continental deposition in fresh water, with a general relation to the Rotliegendes of Middle Europa.

The thickness of the Permian sedimentary series varies much from north to south. Thus the lavas in the Brumunddal area are lying directly on weathered Silurian rocks, whereas around Oslo the series attains a thickness of 20—30 m. From south of Drammen to Horten only the quartz conglomerate is observed, and even this is lacking in some places. In the Skien district again Permian shales and sandstones are about 50 m in thickness.

### **The volcanic rocks.**

During the volcanic phase a thick series of volcanic rocks were formed over the entire Oslo region. The volcanics consist of trachyandesitic lavas (so-called rhomb porphyries) and basaltic lavas, with a minor amount of acidic volcanics. The area covered by volcanics exceeded that of the present Oslo region ( $200 \text{ km} \times 40 \text{ km}$ ) and may well have been  $200 \text{ km} \times 100 \text{ km}$ , possibly  $300 \text{ km} \times 150 \text{ km}$ . After erosion had carried off most of the rocks, the present volume is about  $300 \text{ km}^3$ . The lava series may have had higher members which are now removed and the total volume may have been as much as  $6000 \text{ km}^3$  or more (Oftedahl 1952).

The eruptions may be divided into three phases. The first phase of volcanism consisted in the formation of a lava plateau comprising between 10 and 20 single flows of great horizontal extension. These effusives are clearly fissure eruptions, as early pointed out by Brøgger. The second phase is characterized by a number of volcanic centers with large basalt volcanoes with minor amounts of acidic (ignimbritic) rocks and by explosive centers associated with similar acidic rocks. During the third phase the volcanic activity returned to fissure eruption type.

The detailed stratigraphy of the lava flows was first worked out for the Krokskogen lava plateau by Brøgger, Schetelig and collaborators in the period 1910—17. This proved possible because the different

# PERMIAN ROCKS AND STRUCTURES OF THE OSLO REGION

BY CHRISTOFFER OFTEDAHL

## Introduction.

The German geologist Leopold v. Buch first described parts of what is now known as the Oslo region as an especially interesting district, in 1810. A first map and regional description of "Das Christiania Übergangsterritorium" was published by B. M. Keilhau in 1838. The correct relationship between the volcanics and the underlying Cambro-Silurian rocks was established by Th. Kjerulf. From his work in the years 1855—1880 may be mentioned several maps and the correct interpretation of the faulting of the region, the cross-cutting nature of the plutonic rocks, the contact metamorphism, etc. But the Oslo region is first of all known from the works of W. C. Brøgger through more than 50 years. Most famous is his monograph of 1890 on the geology and mineralogy of the Langesundsfjord pegmatites, a volume of 900 pages. It also contains the first general account of volcanic, plutonic and dike rocks of the region, described as families of decreasing basicity.

Soon afterwards Brøgger (1894 a) was one of the first to point out that magmatic differentiation is governed by the laws of crystallization. Then followed Brøgger's series: "Die Eruptivgesteine des Kristiania- (Oslo-) gebietes" in 7 volumes. The first one appeared in 1894, the last one in 1933. In this last volume he published 331 rock analyses of igneous rocks, accompanied by general geological comments. Complete references to the publications of Brøgger is found in Barth (1945a) and to the older literature in Holtedahl (1934).

The age of the Oslo rocks was finally determined in 1931 when O. Holtedahl found Permian fossils in sediments just below the lavas.

After the death of Brøgger in 1940 a new series of monographs (in English) was started by O. Holtedahl and T. F. W. Barth. This series has now 16 volumes (1960). Short general surveys on the Oslo region are published by Holtedahl (1934, p. 340—356 and 1943.